COAL AGE

Established 1911—McGraw-Hill Publishing Company, Inc.

DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

New York, May, 1932

Volume 37 . . . . Number 5

Who Chisels Prices?

ECONOMISTS generally are agreed that there can be no marked upturn in business until commodity price levels begin to rise. This is an opinion which the average industrialist, looking at the red figures in his monthly balance sheets, heartily indorses.

DESPITE this accord, however, many captains of industry continue to lead their organizations in sales policies which pyramid net operating losses. Justification for this course is sought in bitter denunciation of the buyer as a chiseling wrecker of business prosperity.

THAT some purchasing agents have allowed their sharpened bargaining instincts to encourage—at times, perhaps, unscrupulously—ruinous price competition between bidders for their patronage may be admitted. But to make the buyer the universal scapegoat is an unsportsmanlike shifting of responsibility and postpones the application of corrective measures.

MANY purchasing agents who endeavor to deal equitably with their sources of supply find their efforts defeated by frantic sellers. "Our hardest job," declared an executive officer of one large consumer of raw materials, "is to keep the seller from cutting his own throat."

EXAMPLES like this can be multiplied in every industry. The bituminous trade—a notorious offender against sound price policies—is replete with them and almost every public announcement of bids reveals further evidence of a greedy fever to increase its losses on sales of industrial coal.

MOST industrial buyers ask only to be placed on an equal footing with their competitors. When, as frequently happens, failure to place an order the day after a price is named results in the bidder's voluntarily cutting his own quotation, who is the chiseler?

NO Artful Dodger cry of "stop thief" will cure the situation. As long as industrial sellers persist in depressing prices to levels which wipe out all the savings effected by sane cost-reduction programs, there can be no sound expectation of a revival of profitable business.

SYNCHRONOUS DRIVES + For Mine Fans Open Way to Economies

By R. S. SAGE

Industrial Engineering Department
General Electric Co.,
Schenectady, N. Y.

DURING the past few years, there has been a general checking up and revamping of ventilation systems. As a result, many faulty conditions, such as excessive pressures and misapplications, have been corrected. When it is realized that the mine fan frequently is responsible for 15 to 25 per cent of the total power demand, the importance of securing the highest practicable efficiency is readily apparent. Selection of the fan drive can play no small part in this search for efficiency and economy.

Chiefly because of its adjustable-varying speed feature and for the smoothness of starting which it affords, many mines have selected the wound rotor (slip-ring) induction motor for their fan drives. Where speed adjustment is not necessary, the simple squirrel-cage induction motor has found frequent application. Multi-speed squirrel-cage motors with two, and sometimes three, operating speeds also have found favor.

Although the advantages of synchronous drives were early recognized, general use of this type has been held back, largely, no doubt, because of the onus associated with the synchronous motor for power applications of any considerable severity. During recent years, however, many of the performance limitations to which the earlier type of synchronous motor was subject have been removed. Development has been carried to a stage where, with relatively few exceptions, standardized designs of synchronous motors may be applied to power machinery with the same success as would be expected from the squirrel-cage induction motor. This is particularly true of starting performance; the torque characteristics of the modern synchronous motor generally closely parallel those of the squirrel-cage induction type.

In mining operations where feeder circuits and transformers have become overloaded due to the gradual growth of installed induction motor capacity or where central-station power service contracts have incorporated the power-factor clause, the synchronous motor has come into consideration as a possible replacement drive for induction motors.

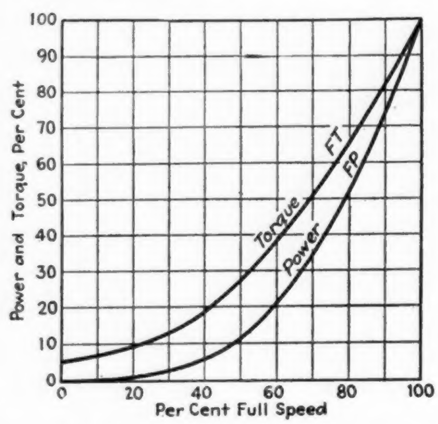


Fig. 1—Typical Centrifugal Fan Characteristic Curves. Variation of Fan Torque and Power With the Speed. Torque Assumed to Vary as Square and Power as Cube of the Speed

Where conditions are such that appreciable advantage and economy are obtained from operation of the fan at variable speeds, the synchronous motor is automatically eliminated, although it is possible to build a multi-speed motor of this type with a speed ratio of two to one and a few such have been constructed and are in use in other services. The recent trend, however, especially in highly gaseous mines, is to operate the ventilating fans at full speed and to supply full quantity of air to the mine at all times. Under these conditions the synchronous motor may become desirable, (1) because of the reactive current it is capable of generating with which to raise the power factor of the mine load, and (2) because of the direct saving in the cost of electric energy due to its higher efficiency.

Economy is, therefore, realized both directly due to the saving in energy charge and indirectly in the saving of a penalty against low power factor or in the investment in greater transformer capacity, feeder copper, and switching equipment. Less tangible, but none the less real in many cases, are the better conditions of power supply due to closer voltage regulation obtained with the elimination of heavy wattless currents. The benefits of power-factor correction by means of synchronous motors usually are desirable whether derived from the reduced charges in the case of purchased power or from lower losses and smaller investment in electrical units and distribution lines in the case of generated power.

These advantages are most pronounced in the larger capacities and, while in a particular case even smaller sizes may be justified, in general the advantages, especially in efficiency, are definite and conclusive for drives of 100 hp. and greater. Although the initial cost of the synchronous motor usually is somewhat higher than that of the squirrel-cage motor, the money saved during the first year's operation from direct energy charge alone usually will amount to the difference in first cost. While the capacity of the motor required to drive the ventilating fan may be small as compared

with the total connected load, it should be remembered that its load factor is 100 per cent, with resulting energy consumption, which is relatively large and usually as great as that for hoisting and haulage.

The value of the synchronous motor from the standpoint of its ability to correct power factor must be determined for each individual case after a study of the general situation. The corrective effect will depend upon the relation of the motor capacity to the total load and its power factor, but situations doubtless are plentiful where definite benefits can be realized, especially where the motors are designed for 80 per cent leading power factor or less.

Serious consideration of the synchronous motor is warranted wherever new electric fan drives or motorization of steam fans are contemplated, and a study of the power conditions in other instances may indicate improvements sufficient to justify the replacement of existing induction motor systems.

There are a number of characteristics peculiar to the mine fan which have an important bearing upon the driving motor and these should receive special consideration when synchronous motors are involved. With but relatively few exceptions, mine fans have either their intake or discharge opening connected directly to the mine airshaft without intervening gates or shutters. As a consequence, the fan begins to deliver air immediately it starts to revolve, the air load increasing with the speed until at full speed the fan load has reached its maximum steady normal value. This characteristic is shown in the power and torque curves, *FP* and *FT* of Fig. 1.

If during starting it were practicable to close off the fan casing from the mine opening, the fan load at full speed could be reduced to from 50 to 70 per cent of full load and the "pull-in torque" required of the motor could thus be materially reduced. Such conditions are quite readily obtainable with centrifugal pumps by closing the discharge valve. The torque required at the instant of breakaway from rest is relatively low, being only that necessary to overcome bearing friction, and never imposes any handicap upon the motor, which usually is capable of developing sufficient torque, even when started with reduced voltage.

There are two conditions which especially affect the design of the motor for this service: (1) the torque required at the moment the motor is synchronized; (2) the heat storage capacity necessary in the starting winding. Both of these are determined by the fan air load during starting and by the inertia of the fan runner. In Fig. 2 is shown a typical full-voltage speed-torque curve of a synchronous motor, together with the fan torque characteristic curve, *FT* from Fig. 1.

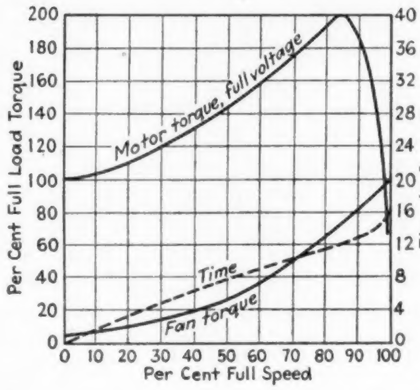


Fig. 2 — Curve Showing Speed-Torque Curve of a Typical Synchronous Motor Starting on Full Voltage. Also Speed-Torque Curve of Fan and Curve Showing Time for Acceleration, for a Fan Operating at 180 R.P.M. and Having a WR^2 of 200,000 $Lb.Ft.^2$

The motor torque in excess of the fan load torque is available for accelerating the fan, this excess multiplied by the time taken to reach full speed being a measure of the energy stored in the rotating parts. Acceleration ceases when the point is reached where the torque of the load equals that of the motor—a few per cent below synchronism. It is at this point that excitation should be applied to the motor field and the motor allowed to synchronize.

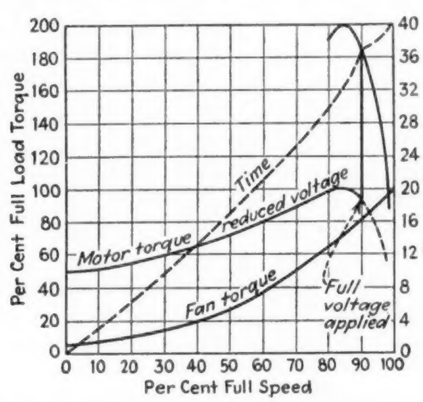


Fig. 3—Accelerating Conditions for Synchronous Motor Started at Partial Voltage

It has been customary to speak of "pull-in" torque as that developed at 5 per cent below synchronism and to assume that synchronizing takes place at that point. Now in closing up this speed differential of 5 per cent, the time is very short and in the order of a few cycles. In this interval, however, the rotating parts are still storing energy—some 10 per cent of the total remaining. Obviously this can be done in such a short time only by the exertion of very high motor torque.

If the fan inertia is of high order, it is quite possible that a motor, even though capable of developing 100 per cent "pull-in" torque (at 5 per cent slip), may fail to synchronize. It usually is necessary in these cases that the squirrel-cage winding carry the load up to 97 to 98 per cent synchronism in order to synchronize. This is equivalent to saying the "pull-in" torque, as commonly expressed, must be much higher than full load and possibly as much as 150 per cent or even greater.

The WR^2 is a measure of the kinetic energy which the rotating parts will have at full speed and determines not only the value of the "pull-in" torque the motor must exert but also the thermal capacity of its starting winding. During starting, this winding must absorb, without attaining an excessive temperature, an amount of energy, which appears as heat, equal to that stored in the revolving parts of the fan and the motor. The heat generated in the bars has little opportunity of dissipation by windage, although much may pass from the bars to the field laminations, and the temperature rise is least for quick starting under full voltage.

From the above discussion it evidently is not possible to select, with complete assurance of suitability for mine fan service, synchronous motors from manufacturers' standardized lists unless the effect of the WR^2 of the fan has been determined. The influence this may have upon the motor can be known only when the complete motor design details are available.

On account of the low breakaway torque of the fan, it is always feasible to start the fan motors on reduced voltage with an auto-transformer or series reactor, because in most cases moderate speed motors are used in which the starting torque developed is seldom less than full load. Referring to Fig. 3, the motor torque curve shows the conditions for starting in this manner from a 70 per cent auto-transformer tap. When the speed has become constant, full voltage is applied, acceleration is completed, and the motor is synchronized.

The dotted lines of Fig. 2 and Fig. 3 show the approximate time curves for full and partial voltage starting,

the time to reach full speed depending upon the WR^2 and the difference between the motor torque and the dead load torque. For the case involved, acceleration is completed in approximately 16 seconds with the motor starting under full voltage and in about 42 seconds on partial voltage.

In general, the partial voltage method of starting is preferable because the torque at start then becomes commensurate with the actual requirements and the demands on the power supply are limited. Moreover, objectionable air pulsations have been found to occur in some instances where acceleration was accomplished too quickly. This condition apparently accompanies high-pressure installations or where the air passages through the mine are of exceptional length. The heat generated in the squirrel-cage winding, however, is greater than it would be were the motor started on full voltage, and in a given case this method might be undesirable from this standpoint.

Starting on full voltage is entirely practicable with the synchronous motor for this service and is specified where the conditions of power supply can withstand the comparatively heavy starting currents and where simplicity of starting equipment is particularly desirable. A motor developing a speed torque characteristic such as that shown by the curve of Fig. 2 would be suitable for either full or partial voltage starting, as 100 per cent torque at breakaway should not be too great to apply to the fan or the transmission.

The breakaway torque might be made even lower, but usually at the expense of somewhat higher power inrush. A satisfactory compromise usually is possible between the somewhat conflicting conditions of large thermal capacity, high pull-in torque, low starting torque, and low starting kva. The latter usually varies between the limits of 400 to 700 per cent, depending upon the speed of the motor and the design as influenced by the inertia of the fan.

In this service the speed of the fan usually is such as to make a speed reduction desirable between motor and fan. Transmissions using leather belts, metal link belts, gears, and V-belts have been employed, usage following a trend in the order stated. Synchronous motors are adaptable under all of these conditions, as they are available in a wide range of speeds. An examination of the starting conditions as shown by the curves given in Figs. 2 and 3 will show the importance of conservatism in the design of the transmission. The rapid rise of the motor torque near the end of acceleration subjects the drive to severe overloads and may cause slippage or throwing of belts or strain upon chains or gears unless these are selected with adequate margin over the normal running requirements. These conditions are typical of those inherent in all motors employing squirrel-cage starting windings applied to high inertia loads.

Unlike the induction motor, which is handicapped at low speeds by its low lagging power factor, the synchronous motor can be built for any desirable speed at unity or leading power-factor. Therefore, with the trend in fan design toward somewhat higher speeds, it may be entirely practicable to consider motors for direct connections to the fan where new units are involved. At the lower speeds, the problem of starting winding design may become somewhat greater, reflecting higher motor cost, but the total cost may still be in favor of the direct-connected arrangement and a net advantage in operating cost and reliability secured by virtue of the elimination of the transmission.

The lower the speed of the motor for this service, the lower the kva. inrush usually becomes, and in some cases this, on full voltage, may not greatly exceed that drawn by a high-speed motor at reduced voltage. There is therefore the possibility of using a full-voltage starter with the advantage of greater simplicity and saving in its first cost to credit against the higher cost of the lower speed motor.

Standard types of starters are applicable to synchronous motors for this service, the present leaning being toward the automatic type actuated from a pushbutton. These are available for both reduced voltage and full voltage starting. Reduced voltage starters usually utilize an auto-transformer, although series reactors may be used to obtain greater simplicity, as one switch may then be eliminated. For the same applied voltage, however, the current inrush is greater with the reactor.

Instead of using a reduced voltage starter, similar results in reducing the starting current and torque may be realized with a motor having a double-circuit stator winding. The primary connections for this system are shown in Fig. 4. At start one branch of each phase is energized, the other being paralleled with it when full speed is reached. By this means the starting torque is reduced to approximately 50 per cent and the inrush current to about 70 per cent of the values at full voltage.

These conditions are very close to those obtainable with the reactor system. The reactor and auto-transformer are eliminated, the only switch required in addition to the line switch being a 2-pole contactor to close the Y-point of the second circuit in parallel with the first. The two-circuit motor is admirably adapted to fan and centrifugal-pump drive and usually costs about the same as the single-circuit motor including reduced voltage starter. It is adaptable to almost any horsepower, voltage, and speed likely to be encountered in mine-fan service.

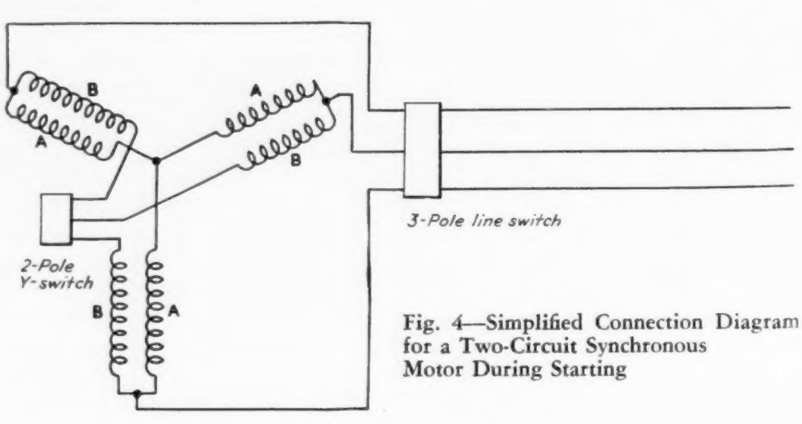


Fig. 4—Simplified Connection Diagram for a Two-Circuit Synchronous Motor During Starting

LOADING MACHINE

+ Handles Coal and Rock In Thin-Vein Longwall Development

By J. H. EDWARDS
Consulting Editor, Coal Age

TO HANDLE successfully the driving of haulage headings in the new longwall conveyor mine of the Pruden Coal & Coke Co., Pruden, Tenn., a loading machine should be equally efficient in loading either rock or coal and must be able to reach back under a rock ledge 30 in. high and clean the coal from the back of a 7-ft. undercut. Last July the company purchased a Myers-Whaley Automat for this duty and by its use is effecting an attractive saving in driving the haulage roads.

The experimental work that has been carried on at Pruden in opening of the 30- to 42-in. Jellico coal was described several months ago (*Coal Age,* Vol. 36, p. 234). Above the coal there is 6 to 8 in. of drawslate, then 4 to 5 ft. of frail slate, and above that 6 to 10 in. of coal. The section is illustrated in Fig. 1. In taking top on these headings, it is desirable to stop with the thin strata of rider coal, which would provide a 7-ft. clearance. More often, however, the rock above is of such nature that 12 in. or more of it has to be taken, so that the average heading height is nearly 8 ft. The width is 12 ft.

Cutting is done with a Goodman mounted center cutter which cuts along the division line between the coal and drawslate. So far as possible, the kerf is made to include about 3 in. of the coal and 3 in. of the cannel slate above. Seven feet is the regular depth of undercut.

Eight men comprise the development crew operating with the Myers-Whaley Automat. These eight men handle all of the work, including tracklaying and hauling the rock and coal approximately 2,500 ft. to the outside. Four of the men make up the preparation crew. They lay track, drill holes in slate and coal, load the holes, operate the cutting machine, and clean out the kerf. The holes in the coal are loaded before the cutting is done.

The two men who operate the Automat bring it to the face and load the machine cuttings, which material goes to the refuse. After backing the Automat about 25 ft. away from the face they shoot the coal, which is loaded immediately and fills 2 to $2\frac{1}{2}$ cars holding approximately 3 tons each. The Automat is again backed away from the face, but this time about 50 ft., and the rock shot down. This also is loaded at once and makes up 4 to 8 cars of about 5 tons each.

Two men using one locomotive shift cars at the loading machine and haul the coal and rock to the outside. After seven cars have been loaded, a trip is made to the tipple. Arrangements are being made to provide new cars which will hold 7 to 8 tons of coal.

It is the aim to have the crew of eight men working in four places with the one loading machine and other equipment complete eight cycles per day of eight hours. One cycle comprises drilling, cutting, shooting, loading coal, loading rock, and all other operations. To date the

Fig. 1—Face of Haulage Heading With Coal Loaded but Before Top Rock Has Been Shot

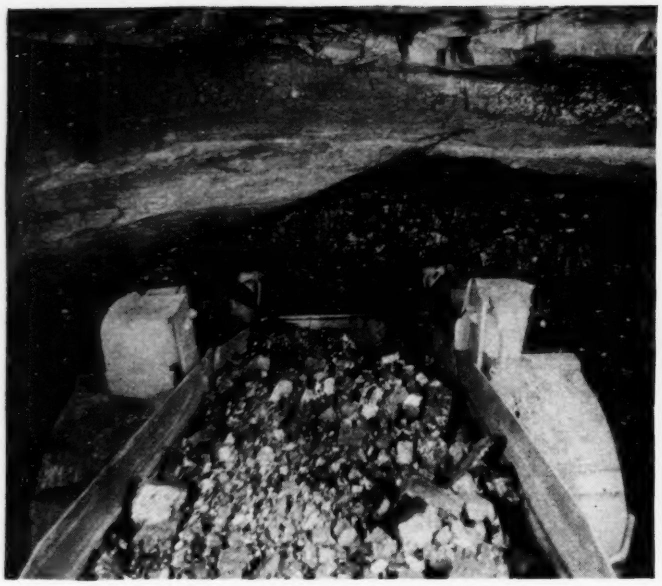


Fig. 2—Reaching Back Under the Rock to Get the Coal

Fig. 3—Loading Top Rock Shot Down After Coal Is Loaded

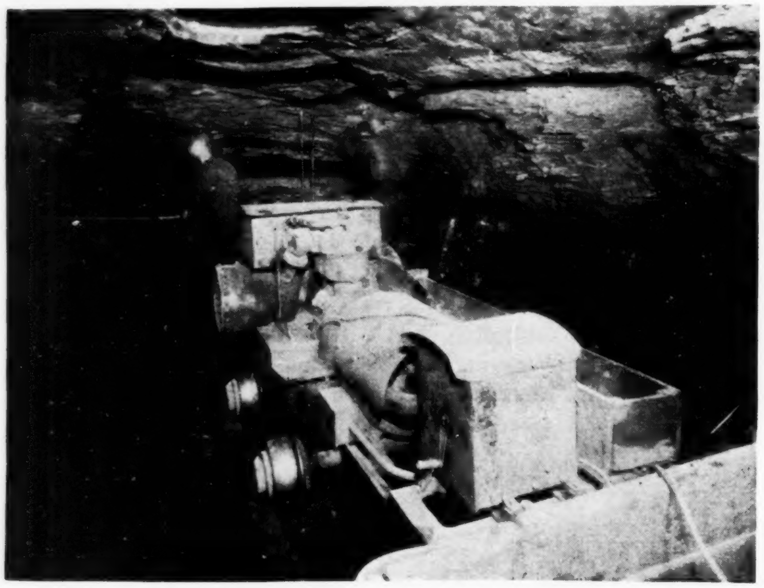
attainment has been an average of about six cycles with a maximum of seven. Hope is still held to co-ordinate the haulage and related jobs so as to complete eight cycles per day.

Fig. 2 shows the Automat reaching under the rock and loading the coal. In this instance, however, much of the slate or rock had fallen when the coal was shot; therefore, the working height for loading the coal is greater than usual.

Fig. 3 shows the shoveling mechanism loading the rock. This Automat in use at Pruden is the No. 3 size equipped with chain flight conveyors. As to its ability to reach under a ledge, the manufacturers rate it as requiring 33 in. above the rail at the front of the cut when loading a 7-ft. undercut. The machine weighs about $7\frac{3}{4}$ tons and is driven by one 20-hp. motor. The rated capacity is 2 tons per minute average, and 6 tons per minute maximum.

That the loading machine is wheel-mounted and requires track is considered no disadvantage in driving the haulways at Pruden. Track would be required when the heading becomes a haulway; therefore it may just as well be laid as the place is driven. Also the track makes it possible to use the mounted mining machines which reduce cutting cost. West Virginia Rail Co. steel turnouts complete with ties and rails, and provided with incline points so that the whole is superimposed on existing track, are used in the mine. With this type of portable turnout, the main-line rails are not disturbed in any way. These turnouts have proved successful at Pruden in carrying the loading machine and other heavy equipment without derailments.

Fig. 4—Demonstrating the Air Drills—Rotary in Coal at Left, Jackhammer in Rock at Right



In some of the places now being driven the rider coal disappears, which condition complicates the work because the drilling for rock shooting must then be done in the rock instead of in the rider coal. This requires a hammer drill instead of an auger. An electric drill was used exclusively until the development began to encounter places devoid of the rider coal.

In these places the rock-drilling is now being done with an Ingersoll-Rand Type R39 37-lb. jackhammer powered from a 5x5 Type 20 portable mine car compressor of the same make. With this equipment an Ingersoll-Rand Size C rotary-type air-operated drill is being tried for drilling the coal. It weighs but 27 lb., which is much less than an electric drill of the same capacity.

Development of the new mine is still proceeding with caution. The layout has been so changed that the hauling from the 300-ft. walls will all be done through undisturbed territory. Use of the temporary tipple will be continued until the management has determined with reasonable certainty all of the mining conditions or methods which must be taken into consideration in the design of a new preparation plant.

WOODWARD MINE

+ Cave, Explosion, and Recovery

By P. H. DEVER
Assistant to General Manager
Glen Alden Coal Co.
Scranton, Pa.

THE operations of the Woodward colliery, a property of the Glen Alden Coal Co., embrace about 1,100 acres, located in Edwardsville, Luzerne County, Pennsylvania. Shaft sinking started in 1881, and on July 14, 1888, coal was prepared at the first breaker constructed. The colliery has four openings: Shafts Nos. 1 and 2 and No. 17 slope, all within a short distance of one another; and No. 3 shaft, about a mile away from the main part of the colliery.

The following beds are mined: Snake Island, Abbott, Kidney, Hillman, Five-Foot, Lance, Cooper, Bennett, Top Red Ash, and Bottom Red Ash. North of the main basin, Cooper and Bennett beds are separated by 60 to 80 ft. of rock strata; on the south side of the basin, the two beds come together, forming the Baltimore bed.

From the West Gangway in the Bottom Red Ash bed, No. 1 shaft, a 7x16-ft. tunnel 3,000 ft. long, known as No. 2 tunnel, was driven across the dip of the measures, intersecting the Top Red Ash, Ross, and Bennett beds. This haulage road was extended on a 5-per cent upgrade through the Cooper and Baltimore beds by rock tunnels, eventually connecting with the bottom of No. 3 shaft. A slope was sunk in the Cooper from the Bennett bed shaft level via No. 1 tunnel to the south basin and then upgrade until it intersected the Baltimore bed haulage road, 100 ft. south of No. 8 West Lift in the area adjacent to No. 3 shaft. Both roads were used for haulage and inlet airways, all the coal mined on the various lifts in No. 3 shaft being transported via the haulage roads, to the Bennett and Red Ash levels in No. 1 shaft, where it was hoisted to the surface.

All the beds have been developed to some extent over the entire property; many of them are connected by rock tunnels, slopes, and planes for haulage and ventilating purposes. They all liberate methane freely, necessitating an elaborate ventilating system, which consists of seven Guibal exhaust fans, four of which are in constant use, circulating 1,200,000 cu.ft. of air per minute, three being kept in reserve.

When mining in the Cooper, Baltimore, Top and Bottom Red Ash beds advanced to the main basin it was found impossible, because of the gassy condition of these beds, to proceed any farther to the southward; therefore, No. 3 shaft had to be sunk for ventilating and hoisting purposes. This shaft was started in 1907. Because of the great depth of wash, the Foundation Co., the contractors which drove the shaft to bedrock, adopted a method of sinking hitherto not used in the anthracite region.

The surface wash was excavated to a depth of 15 ft., at that time 1 ft. above ground-water. A reinforced-concrete caisson, 28 ft. wide, 59 ft. 6 in. long, and 102 in. deep, increasing in thickness from 2 ft. 8 in. at the top to 7 ft. at the bottom, was made by building a portable wood form and placing therein reinforcing material and concrete. The caisson was provided with a steel cutting shoe and was strengthened by two reinforced-concrete walls 20 and 24 in. thick extending its entire length, and tapering gradually to a thickness of 12 in. at the top. These walls were reinforced with 1¼-in. diameter steel rods.

After the concrete had sufficiently set, the earth beneath the caisson was excavated, causing the latter to sink by its own weight. While it was thus lowered, the forms were transferred to the top of the caisson. When the top of the new form had sunk almost to surface level, reinforcement was again laid and concrete poured. Thus proceeding, the caisson was lowered till, finally, it rested on bedrock.

From this point the shaft was excavated through the rock and coal measures to the Baltimore bed, a depth of 801 ft. below the surface. The shaft ribs below the concrete caisson were supported by yellow-pine ring sets 10x10-in. and 12x12-in. square, placed on 5-ft. centers and cribbed with 3-in. yellow-pine plank.

Shaft sinking was completed in about two years, and work started to connect a single entry in the Baltimore bed with the already described haulage road from No. 1 shaft which passes through No. 2 tunnel and the Cooper and Baltimore beds. After the completion of the haulage road and necessary airways, development of the property was started in the Hillman, Lance and Baltimore beds and still later in the Kidney and Five-Foot seams.

Because the Baltimore bed was of abnormal thickness its 20-ft. chambers were driven on 100-ft. centers. The first mining of these beds continued without apparent difficulty until May 26, 1927, when a cave occurred in the Baltimore bed, extending from the 7th to the 10th West Lifts, without, however, involving the main haulage road connecting No. 3 with No. 1 shaft.

The bed where the cave occurred is 850 ft. below the surface, and the seam thickness is about 24 ft. Shortly after the cave, a terrific gas explosion occurred, the force of which was severely felt on the several levels of No. 3 shaft. This explosion drove clouds of dust up the shaft to the surface. It is apparent that when the descending rock suddenly crushed the pillars it liberated a large quantity of gas, which was carried by air currents through the workings. In some manner not determined, this gas became ignited in the vicinity of the 9th

West Lift off the main haulage road. The original and subsequent explosions involved seven seams, all intersected by tunnels, rock planes, or vertical shafts; namely, the Kidney, Hillman, Five-Foot, Lance, Cooper, Baltimore and Red Ash. The explosion seriously injured eighteen and killed seven men instantly.

Emergency rescue crews rescued the eighteen injured and recovered two bodies. Everything possible was done to recover those of five other men—the mine foreman, a section foreman and three miners—but without avail, for they were buried in the cave, and gas made the workings inaccessible. The exact location of these men at the time of the cave has never been determined.

The outer edge of the cave and adjacent workings were carefully explored and inspected for gas and fire. Tests showed that the air in the main return was highly explosive, but without trace of carbon monoxide. A small fire, which was promptly extinguished, was discovered in a crosscut on the easterly side of the main haulage road between 8th and 10th West Lifts. After several mine inspectors and mine officials had carefully inspected all accessible workings to discover fire and found none, the various air splits which the concussion had disrupted were restored, as far as possible, to normal conditions. This restoration was completed by midnight of May 26. A rescue crew under the supervision of competent mine officials started on the 8th West Lift off the main haulage road to clear up local falls on the outside rim of the general cave, propping the roof as they advanced.

This work continued until 5:15 a.m., May 27, when all the men were sent to the surface. The men of the morning shift, who were to replace the night crew, were standing in the vicinity of the shaft lamproom and the men of the night-shift crew were leaving the property on their way to their respective homes, when a second explosion occurred at 5:50 a.m., May 27. This explosion completely destroyed the reinforced-concrete fan drifts which connect the upcast shaft with both ventilating fans. Thus all means of ventilating the workings at No. 3 shaft were destroyed. Two men were seriously injured when the headhouse, a small building in which they were sitting, collapsed. During that day, May 27, at intervals, many explosions occurred in the mine.

The second explosion so wrecked shaft No. 3 that the cage in the westerly hoistway could not be lowered beyond the Hillman bed, 400 ft. below the surface. This shaft could not, therefore, be used for ingress. Hence, the workings could be approached only through the 1¼-mile haulage road from No. 1 shaft, and this haulage road was like a long gun barrel through which the force of every explosion of gas would have to travel either in the direction of the main shafts or toward No. 3 shaft. It was suicidal, therefore, to use this route to reach the affected area.

After a consultation held by mine officials, several mine inspectors and the Secretary of Mines of the Commonwealth of Pennsylvania at 4 p.m., May 27, it was decided: (1) to short-circuit the small air currents produced by No. 1 and No. 2 shaft fans so as to exclude them from the No. 3 shaft section, and (2) to seal the top of No. 3 shaft so as to prevent air from entering at that point.

This work was started at 4:30 p.m., May 27, and was completed at 3 a.m. of the next day.

At 1 a.m. of the following day, May 29, the most frightful explosion in the annals of anthracite mining occurred. Its concussion was felt for a distance of 40 miles. The surface buildings near the top of the shaft No. 3 were partly wrecked. A steel tower weighing 250 tons was torn loose from its anchorage and toppled over on its side. Two cages, each weighing 3 tons, suspended about 4 ft. above the top of the temporary seal, were completely destroyed.

A piece of one of the shaft guides about 15 ft. long was found, embedded in the ground, at Kirby Park, a quarter mile from the shaft. Blocks of concrete that were torn loose from the foundation and shaft caisson were found at various distances from the shaft. The partition walls within the reinforced-concrete caisson were destroyed, the caisson was sprung on each of the four corners from 1 to 14 in. and to a depth of about 60 ft., and the earth fill surrounding the top of the caisson was pushed back.

These fractures in the caisson permitted four streams of water of about 1,000 gal. per minute to fall into the shaft.

W. W. Inglis, president of the company, summoned the presidents, general managers and superintendents of all the large anthracite operating companies to a consultation in the Woodward colliery office, Sunday, May 29. The state was represented by the Secretary of Mines and several mine inspectors.

Several tentative plans were given serious consideration, one a proposition to flood the mine, but it was decided that, if the fire was located at an elevation above the bottom of No. 3 shaft, it would be impractical to flood the mine, and that flooding would result in great destruction to the property with no assurance of success, this because a small vertical shaft connected the Baltimore bed, where the explosion occurred, with the Red Ash bed, which latter bed would, therefore, have to be flooded before the fire would be reached.

A plan was submitted for controlling the fire by sealing the return airway, leading through the Cooper and Bennett beds to the ventilating fan at shafts Nos. 1 and 2 and by resealing the top of No. 3 shaft which was a downcast airway. The mine inspectors and mine officials unanimously accepted this plan. Mr. Dever, was selected, aided by G. V. O'Hara, assistant to the general manager, to direct the placing of the seals, which work was started at 9 p.m., June 1, and completed at 6:30 a.m., June 2. When the return airways were closed, No. 3 shaft became an upcast and was resealed at 5:30 p.m., June 5, 1927.

On June 10 the U. S. Bureau of Mines rescue car arrived at the colliery in charge of J. J. Forbes, George McCaa, and George Groves. On June 11, at 3 a.m., the air in No. 3 shaft showed on analysis:

CO_2	O_2	CO	CH_4
2.4	7.4	2.6	16.7

The temporary seals in No. 1 and No. 2 shaft area, were then replaced by concrete seals and many secondary seals erected.

To make the shaft tight six 4-in. pipes were driven into the fill surrounding it to a depth of 35 ft. directly in front of each of the cracked corners of the caisson. Lumnite rapid-set cement was forced through these pipes under an air pressure of 35 lb., the pipes being raised 2 ft. at a time, but this plan also failed.

The shaft caisson extended some 20 ft. above the natural ground level and was surrounded by a rock fill, which, as already mentioned, had been pushed back by the force of the explosion. Through cracks in the caisson, methane leaked into the rock fill, and whenever a safety lamp was placed close to it a gas cap could be obtained.

A steam shovel operated by compressed air dug a trench 20 ft. deep around the shaft, so that a new wall could be constructed around the

old one, thereby sealing gas leaks.

On July 20, the permanent seal on top of No. 3 shaft was replaced. This consisted of 6x8-in. x 20-ft. yellow-pine surfaced timber placed on 2-ft. centers, over which 1-in. hemlock boards were laid at right angles. On this, ½-in. mesh chicken wire was nailed and the whole covered with 4 in. of paragon wood-pulp plaster, to make an airtight seal.

On June 27, an apparatus crew, led by Mr. Dever and accompanied by Messrs. Thomas, Groves, Miller and Snyder, traveled 3,000 ft. along No. 2 tunnel and up the haulage road to No. 6 West Lift from Air Base No. 1. Here the party discovered positive evidence of fire and took air samples.

On July 19, an apparatus crew traveled 5,200 ft. from Air Lock No. 1, finding a trip of burned mine cars. The ribs and large quantities of loose coal had been on fire. A vacuum sample showed the following:

CO_2	O_2	CO	CH_4
2.3	1.0	0.5	36.9

Air Lock No. 2 was erected 2,400 ft. inby from Air Lock No. 1. On July 23, Air Lock No. 3 was completed, advancing the air base 600 ft. On Aug. 8, fire was located in a gob at the second crosscut in No. 10 West, opposite No. 9 West return airway. The oxygen-apparatus crew traveled from Air Base No. 3 a distance of 2,400 ft. Analysis of air:

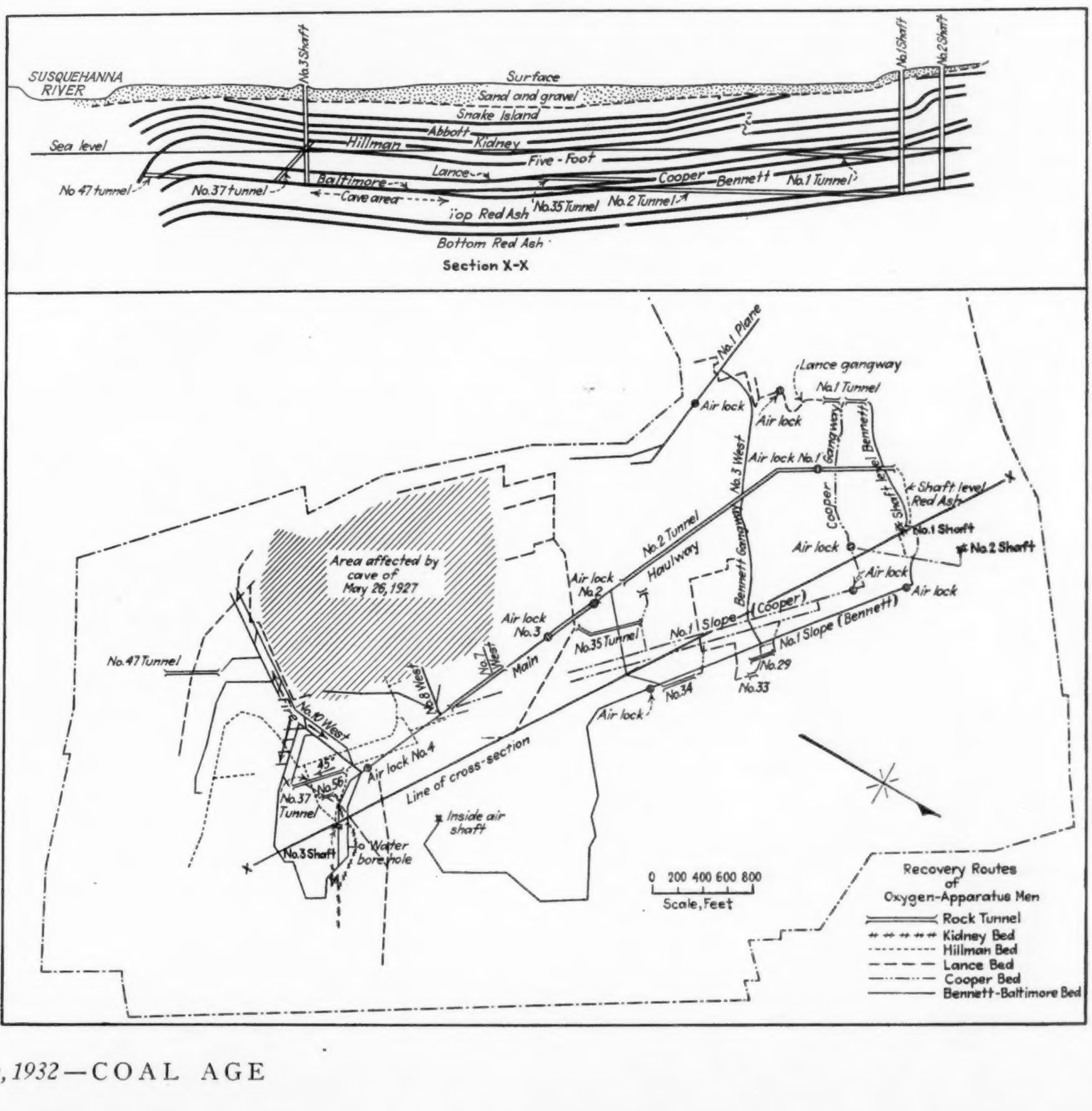
CO_2	O_2	CO	CH_4
1.8	0.4	0.4	45.7

This fire received sufficient fresh air to keep it in a dormant condition through a 6-in. borehole which connected the Baltimore and Red Ash beds, the top of which hole was covered by 6 ft. of loose coal that had sloughed off the ribs in the Baltimore bed. Air came up the hole through this coal to the fire. On Aug. 11, a pipe line and hose was connected to a 6-in. borehole located approximately 150 ft. east of No. 3 Shaft. To this were hooked three chemical fire apparatus on the surface.

After operating these for 3½ hours it was found that none of the chemicals had reached the fire. Later it was discovered that a valve was closed in the borehole line at the Hillman bed 400 ft. below the surface. A passage was drilled through the valve seat by setting up a machine on top of the borehole, the drilling of the seat being completed on Aug. 12. Water was put on the fire on Aug. 14. No explosions of water gas resulted.

On Aug. 21, a continuous internal circulation of 10,000 cu.ft. per minute was discovered. It passed over the fire through a 40-deg. rock tunnel leading to the Lance bed, which is

Exploration Map of Woodward Mine With Cross-Section of the Coal Measures on a Line Between Shafts Nos. 1 and 3



100 ft. vertically above the Baltimore bed. The gases traveled through the Lance and down the pitch 100 feet to No. 47 Tunnel Level, which connected the Lance and Baltimore beds and then passed over the fire. This circulation eventually lowered the temperature of the coal and rock pile to 65 deg. F.

From Aug. 21 to Oct. 26, erection of seals continued in the Five-Foot, Lance, Cooper, and Baltimore beds.

After establishing a fresh-air base at lock No. 4, the apparatus crews continued to play water on the fire, but the temperature fell so slowly that, after making many explorations by use of the McCaa and Gibbs apparatus, it was decided to erect concrete dams on No. 10 West gangway and airway and to flood them with water, so as to reduce the temperature of the caved area. These dams were completed Dec. 6, 1927. They measured 2 ft. 8 in. x 13 ft. x 22 ft. and were supported by flanking walls measuring 2 ft. 10 in. x 6 ft. 5 in. x 13 ft. The material used was carried by the apparatus crews from Air Base No. 4 a distance of 500 ft.

After the completion of both dams, water was discharged through two lines of hose and a 6-in. pipe line. All the seals, dams, etc., were erected between June 1, 1927, and Jan. 1, 1928. While the seals were being constructed from No. 1 to No. 4 air lock in No. 3 Shaft area, apparatus crews erected similar seals in the Lance, Cooper, and Bennett beds. Air locks were erected on the top of the West Cooper, East Cooper. and Bennett bed slopes.

Working from a fresh-air base on the head of the East Cooper bed slope, under a gas pressure of 20.8 lb. per square foot, apparatus crews carried all the material—boards, stone, ashes, and cement—and erected seals across the bottom of the slope 2,500 ft. distant down an 8-deg. dip, and several other seals at various distances in between, completing the work without mishap.

From the air base at the head of the Bennett slope under a gas pressure of 15.6 lb. per square foot, on a 10-deg. downgrade, they erected an air lock and seventeen seals. Then, using the second lock as a fresh-air base, they traveled 1,400 ft. to the basin, which at that time was filled to a depth of 5 ft. with water. Here they had to construct a raft. After several trips to cut through two ventilating doors, the members of the crew got aboard the raft, floated 500 ft. to the South pitch, made their way 900 ft. up a 5-deg. gradient, and sealed the bottom of an airshaft, returning safely to their base over the same route.

The apparatus crews erected 325 major seals and 23 air locks in the Five-Foot, Lance, Cooper, Baltimore and Red Ash beds. The crews consisted in all of 50 men, who were trained by J. A. Thomas, rescue captain of the Glen Alden Coal Co., and Messrs. Forbes, McCaa, Groves, and Miller, of the U. S. Bureau of Mines. Prior to their training, 95 per cent of the men had never used breathing apparatus, but they proved loyal and efficient workmen and performed their duties as directed and never flinched no matter how difficult or dangerous the undertaking.

Including all beds, 1,858 acres was sealed in the first line of defense. This territory contained at least 300,000,000 cu.ft. of methane and noxious gases. The area, as finally sealed, contained 280 acres and 50,000,000 cu.ft. of methane. The apparatus crew traveled from Air Lock No. 4 to the Kidney bed, a distance of 3,000 ft., a climb of 457 ft. Here they disconnected 140 cells of a battery locomotive, comprising 280 connections, and returned safely to the air base. The atmosphere in which they traveled contained 98.9 per cent of methane.

Starting from air lock No. 2 on No. 2 tunnel, they sealed the top of a 16x20-ft. airshaft, 1,520 ft. distant. While doing this work, a breathing bag was ripped asunder in an atmosphere containing 72 per cent of methane and 0.6 per cent of carbon monoxide. One member of the crew fed oxygen to the unfortunate wearer of the bag through a bypass valve on his equipment while another kept the breach in the bag closed. All arrived safely at their fresh-air base.

When the work of sealing, erecting dams, etc., was completed in the underground workings, an air lock was constructed covering No. 3 Shaft caisson. Through the air lock was erected a wooden frame hoisting tower to support the sheave wheels. This work was completed on Jan. 16, 1928. At this time, the caved area in the Baltimore and Lance beds was isolated from the other parts of the mine by substantial concrete walls.

At 6 a.m., four 8-in. relief pipes equipped with valves were installed through the seal on No. 3 Shaft. The valves were opened to release the gas pressure, which had registered 6½ in. of water gage. At 6:30 p.m., the doors on No. 4 air lock were opened and, when the men reported everything in good condition, the seal was broken on No. 3 shaft, permitting gas to escape and fresh air to enter. When the pressure was reduced the ventilating fan was started. After the mine was reventilated, the concrete caisson was repaired, and the shaft retimbered. A 13-in. brick partition wall 702 ft. long was erected to separate the upcast from the other compartments of the shaft. All this work was done inside the shaft air lock.

While the shaft was being repaired, No. 3 Shaft section of the Lance bed directly over the top of the caved area in the Baltimore bed was isolated by erecting a number of concrete seals. This area was formerly cut off by a water seal, but a later squeeze which occurred long after that of May 26, 1927, caused breaks, and the water was lost through crevices to the Baltimore bed.

This squeeze also broke some of the original seals placed north of the separation pillar in the Lance bed and also caused an inward pressure on the seals of the Baltimore bed controlling the caved or isolated area. A brick arch dam was erected in No. 2 tunnel at elevation —375; water was admitted through 6- and 10-in. pipe lines until it reached a vertical height of 87.5 ft., or an elevation of —287.5. Flooding began May 20, 1929, and was completed Aug. 19 of that year. As the air samples could be taken only on the edge of the 118-acre cave, it was feared that fallen rock might conceal a dormant fire, so the area was flooded. The caved areas of the Lance and Baltimore beds were then reventilated.

Carbon-monoxide gas tests were made by a constant carbon-monoxide recorder, placed in the office near the head of the shaft. As a further check Orsatt tests also were made. Whenever the carbon-monoxide content was below the range of the Orsatt apparatus, pyrotannic blood tests were made.

After the shaft seal was broken to release the methane and the ventilating fan started, a constant methane recorder, connected to the upcast by a 1-in. pipe, was installed in the engine house. This apparatus registered the percentage of methane in the air. When, due to fluctuation of the barometer, the quantity of methane reached 2½ per cent, the work of repairing the shaft was stopped until the pressure became normal and the quantity of methane fell to 1 per cent.

WHAT CONSTITUTES + Fair Depletion?

By A. W. HESSE
Mining Engineer
Buckeye Coal Co.
Nemacolin, Pa.

MANY and divergent have been the methods suggested for determining correct depletion charges for coal properties, some for the purpose of providing for the recovery of the original investment plus a reasonable return, others for use in making tax returns, and some, perhaps, for both these purposes.

Many times since taxation was first levied on incomes has it been stated that mining is a wasting process, or, in other words, that a mine consumes, rather than utilizes, its property. Someone has said, "Deplete the property and you destroy the mine."

A committee of the American Institute of Mining and Metallurgical Engineers, in 1919, made the following statement: "Depletion should be a sum calculated to return to the owner, free of tax, the cost or value, as the case may be, of his mineral property. This should be calculated either on a unit basis by dividing the estimated value or cost by the estimated units, or as a percentage of the annual income as it stands before depletion has been deducted, the said percentage to be the ratio of the cost or value of the property to the total estimated earnings.

"The committee recommends that distributions to stockholders made from depletion reserve are liquidating dividends and do not constitute taxable income to a stockholder; and that said distributions under the law may be made from such reserve, irrespective of the condition of the surplus and undivided profits' account of the corporation."

If, in his depletion account, the owner of a coal property does not provide a fund sufficient to equal the cost of replacing the coal mined, instead of one merely equaling the original cost, surely he is going to be in a sad state when his property is gone, unless he should await the time when the business cycle again reaches the low point of 1931.

It is no easy matter to determine what charge per ton of output, deducted each year from the operating profit before subtracting the tax due the Treasury Department, will afford, within the life of the property, a sinking fund that will amortize the investment.

There may be a difference between what was actually paid for the coal land and what the owner or appraiser would regard as its true value. To all intents and purposes the Treasury Department permits depletion charges for returning either (a) the cost of the property, or (b) the value of the property as of the basic date, March 1, 1913, plus, in either case, subsequent allowable capital additions, etc.

A. W. Hesse

The owner is obliged to furnish the Treasury Department with an evaluation of the property. In whatever way that evaluation may be made, it is incumbent on the owner to set forth "the basic date at which the property is valued and the value of the property on the basic date, with a statement of the precise method by which it was determined" (Regulations 65-1924, Article 218).

The value of coal decreases in proportion to its distance from the railroad tipple or dock at which it is loaded for shipment. It has been recognized that developed coal is of greater value than undeveloped coal because of its immediate accessibility, which, by aiding in its earlier marketing, lowers the charge for interest that the developed coal must carry.

Further, we must not forget that the "law of diminishing returns" is peculiarly applicable to a coal mine, at least until it reaches its property limits, for as the workings are advanced to produce the necessary coal output more track must be maintained, more electric feeders, longer trolley and sprinkling lines, larger rock-dusted areas, more telephones with longer connections, and more pumps have to be kept in good operating condition and more roof has to be supported. Unless these provisions are made, transportation will be delayed and production will decline.

Therefore, if all items of cost I have enumerated have been expended, a property fully developed and ready to bring back its pillars will contain coal of greater value than that which is undeveloped, because it will have potentially lower operating costs and a greater salvage value.

Original cost does not always represent the true value of a coal area, notwithstanding the "willing buyer and willing seller" edict. Statistics show a constantly rising curve of values in the United States as a composite of the ups and downs of the business cycle; and even if we are in the trough of perhaps the worst depression* that the past half century of our country has experienced, all predictions are to the effect that the next rise will be stronger and higher than ever. Owners have not always bought wisely, neither have the markets always been such as to set the proper value on a property; but coal fields

*Bureau of Business Research, University of Pittsburgh.

should not suffer because of that, and the tendency of coal, as of other diminishing mineral resources, will inevitably be "onward and upward."

The purpose of this article is to show five methods of determining the depletion rate, any one of which, in its application to coal, may be the correct one and the other four erroneous, because of the many factors that, entering into coal mining, influence results for good or bad: namely, market changes, the type of equipment and plant installed, natural inside conditions, shipping facilities, and management.

In the consideration of this subject, nothing will be said regarding depreciation, as this has no bearing on the life of the mine; furthermore, some equipment wears out in a short time and other equipment lasts longer, yet, from the accountant's viewpoint, the value of the equipment never disappears from his books, for, in order to continue mining operations, replacements are constantly being made as they become necessary.

The five methods herein proposed for estimating depletion are not new and are given solely for comparative purposes. It is necessary to present them all because different estimators will not visualize the problem in the same way, and what to one accountant may appear to be the correct method may have no rating with another. Perhaps, out of the five methods, each reader may be able to find one that will suit his views, with which everybody or, perhaps, nobody will be satisfied.

The depletion fund set up may be (1) sinking fund based on present worth of a steady yearly profit during the life of the mine less the cost of the operating plant, said calculated value of the coal being distributed equally over the life of the property; (2) sinking fund based on receiving original cost at end of life of property, and simple interest on the investment each year; (3) sinking fund based on an average of what would be the annual charges if these charges were increased each year by compound interest; (4) sinking fund to amortize at the close of the life of the mine the entire value of the coal as increased by compound interest; (5) sinking fund, equal to the value of the coal mined as determined by taking the original value and adding compound interest for half the life of the field.

(1) Sinking Fund Based on Present Worth of a Steady Yearly Profit During the Life of the Mine, Less Cost of Operating Plant, Said Calculated Value of the Coal Being Distributed Equally Over the Life of the Property—This method has been advocated since 1917, at which time it was proposed by Clinton H. Crane, president, St. Joseph Lead Co. In 1919, Prof. L. C. Graton presented a paper before the American Institute of Mining and Metallurgical Engineers which expressed the same point of view. In an article published in the *Mining Congress Journal,* March and April issues, 1929, he advocated this method of making one, and only one, valuation from which to establish a fixed percentage between the operating profits and the allowance made for depletion. Operating profit is here understood as the net amount received from the production of minerals before depletion and depreciation have been deducted (see Regulations, Revised Act of 1924).

It may be stated here that, if the percentage is established on an incorrect evaluation, the final result is no more in error than it would be if the depletion were established by any one of the other methods. Be that as it may, let such conditions and symbols be chosen as will apply, as nearly as possible, to every case, to the end that the results obtained may be the more readily compared.

Let a coal property be taken having: *A*, area=5,000 acres, *P*, original price per acre= \$1,000; *G*, merchantable tons per acre=9,000; *C*, tons produced per year=1,500,000; *M*, average cost per ton in the ground, or rate of depletion charge necessary; *N*, number of years of life= 30; *O*, operating profit per year=\$750,000.

By the depletion method, the present worth of these earnings is determined, deduction is made for the plant, and the remainder is averaged as the value of the coal per year, thus:

Present worth on \$750,000 for 30 years on basis of 8 per cent profit and 4 per cent sinking fund, or \$750,000 × 10.22181	\$7,666,357
Less cost of plant (assumed)	4,500,000
Value of coal	\$3,166,357
Cost per year	105,545

This cost compared to the earnings, \$105,545 ÷ 750,000 = approximately 14 per cent. This ratio now remains fixed throughout the life of the property; but note that the depletion charge per ton of coal, \$105,545 ÷ 1,500,000, is only 7.036c., whereas the first cost of the coal in the ground is over 11c. Thus the operator is penalized in his tax returns throughout the entire life of his mine. The remedy for such a situation would be to set the operating profit at a figure commensurate with the investment and hazard; say in this instance, at \$1,500,000 per year, thus:

Present worth on \$1,500,000 for 30 years on basis of 8 per cent profit and 4 per cent sinking fund	\$15,332,715
Plant	4,500,000
Value of coal	\$10,832,715
Cost per year	361,090

Percentage depletion is then \$361,-090 ÷ 1,500,000 = approximately 24 per cent. Then if \$750,000 is the actual operating profit, the allowable depletion charge of \$0.24×750,000= \$180,000, or 12c. per ton, at least covers the first cost per ton of the coal in the ground. If the operator is fortunate enough to make \$2,000,000 or \$3,000,000 per year, naturally his coal becomes more valuable, and the percentage rate provides for the larger deduction for depletion in accordance with that increased value. This demonstrates the need for adequately large percentage depletion allowances, and the justification for percentage depletion itself.

(2) Sinking Fund Based on Receiving Original Cost at End of Life of Property, Plus Simple Interest on the Investment Each Year—Because of the hazards incident to the mining of coal, the industry is warranted in seeking a return of 8 per cent on the coal field, and 4 per cent compounded annually on the sinking fund, or reserves, whereby to recover the investment. From data assumed, we then have:

$$M = 0.08\,A\,P + \frac{r}{(1+r)^n - 1} \times A\,P \div C$$

where r = 4 per cent or 0.04

Substituting

$$M = \frac{(0.08 \times 5{,}000{,}000) + (0.01783 \times 5{,}000{,}000)}{1{,}500{,}000}$$

$= 0.3261$ or 32.61c. per ton

This means that out of the operating profit should be deducted, to carry and recover the investment, \$489,150. This sum would remain fixed; but when tonnage is decreased, even though costs are shaved in accordance where possible, the unit charge becomes larger because the same sum of money is then spread over a smaller tonnage.

(3) Sinking Fund Based on an Average of the Annual Charges for the Coal Mined at Purchase Price Increased Annually by Compound In-

(Turn to page 198)

MECHANICAL CLEANING

+ Promotes Consumer Acceptance Of Powhatan Coal

By JOSEPH PURSGLOVE, JR.
*Engineer, Powhatan Mining Co.
Pittsburgh, Pa.*

THE second bituminous coal-cleaning plant in the tri-state area of western Pennsylvania, eastern Ohio, and the West Virginia Panhandle to use the Chance sand flotation system is located at the Powhatan Mine of the Powhatan Mining Co., about twenty miles south of Wheeling, W. Va., on the Ohio River. This plant handles coal from operations in the southern part of the Pittsburgh No. 8 coal area, and was put in operation on Sept. 21, 1931. The seam at Powhatan Point is traversed by a series of clay veins and spurs which appear uniformly throughout the mine. These clay veins are anywhere from 6 to 60 ft. in thickness, depending upon the angle from which they are approached, and are the major reason for the extreme dirtiness of the mine-run product.

When the problem of bettering the coal by mechanical cleaning was first considered, the writer made float-and-sink tests which indicated that if washing was done at a specific gravity of 1.45 the cleaned sizes would have the following analyses (figures for the raw coal are given for comparison):

	Raw Coal		Clean Coal		
Size	Ash, Per Cent	Sulphur, Per Cent	Ash, Per Cent	Sulphur, Per Cent	Reject, Per Cent
4x6½-in. egg	8.23	4.45	7.00	3.95	4.00
2x4-in. egg.	8.43	4.03	6.71	3.68	4.79
1½x2-in. nut	12.96	5.18	8.61	4.48	9.41
1½x¼-in. pea	11.44	4.58	8.81	4.06	7.25
Total....	.....	....	....	....	6.67

In view of the possibilities for marked improvement shown in the above table, and relying on the satisfactory performance of the Chance sand flotation plant at the No. 8 mine of the Pittsburgh Terminal Coal Corporation (*Coal Age,* June, 1931, p. 286), it was decided to install the Chance system at the Powhatan Mine for cleaning coal from the maximum size which would justify washing down to material of such fineness that the addition of moisture would cause difficulties with the slack. The lower limit was placed at ¼ in., and plans were drawn up with an eye to bypassing coal smaller than this around the washer.

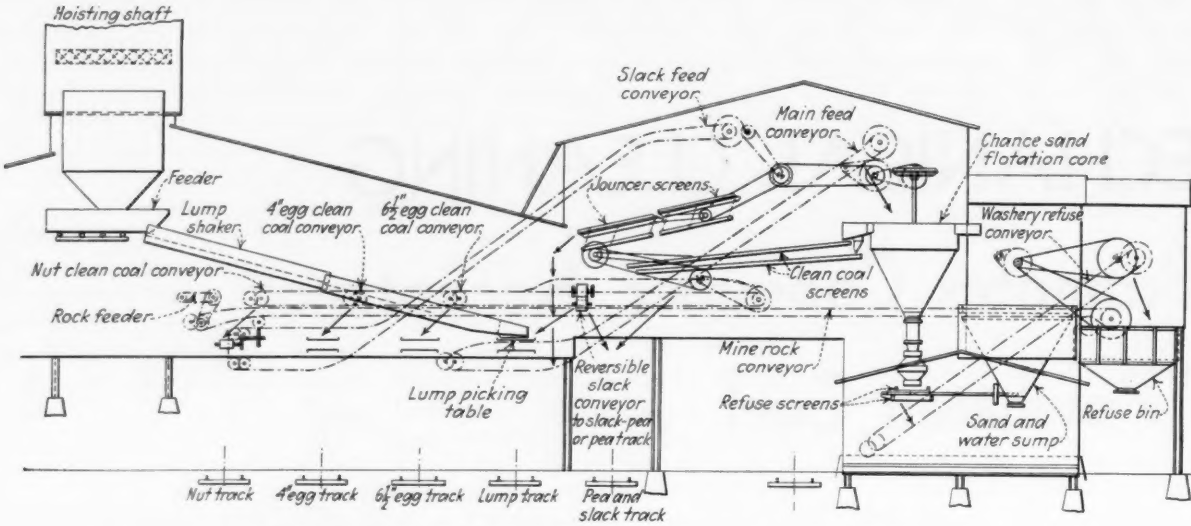
If the ash and sulphur in the larger sizes are reduced sufficiently, it is not necessary to wash the ¼x0-in. coal, thus eliminating the sludge and moisture problems, as well as reducing to a minimum the clarification of washery water before allowing it to flow into the river. Bypassing of the raw coal fines also reduced the quantity of make-up water required because of the fact that the small quantity of degradation sludge is eliminated from the system by means of the relatively small waste water overflow and the various sump sludge discharges.

The present Powhatan tipple was built in 1924 by the Jeffrey Mfg. Co. Coal is hoisted in a skip and was then dumped into a long chute feeding onto a Jeffrey standard type lump shaker screen which, prior to the installation of the washery, separated the coal into 1-in. slack, 1x2½-in. nut, 2½x4½-in. egg, and 4½-in. lump. The slack was chuted directly to the railroad car, and the nut, egg, and lump were loaded by standard Jeffrey steel-apron loading booms. Space was provided on all three booms for the maximum number of pickers. Due to the inherent inflexibility of the shaker screen installation, it was impossible to mix the sizes.

As was the case with the No. 8 plant of the Pittsburgh Terminal Coal Corporation, the new Powhatan plant was designed to make use of the existing lump shakers. The raw mine-run is fed onto the 10-ft. Jeffrey shaker by a reciprocating feeder. The first section of the screen is dressed with approximately 12 ft. of screen plates with ¾-in. round holes for removing the ¾x0-in. fines from the mine-run coal. This material is chuted to a scraper conveyor, which elevates the coal to the top of a system of chutes. These chutes discharge onto two 6x24-ft. Heyl & Patterson "Jouncer" screens, where the ¼-in. slack is removed.

From the first section of the lump shaker, the ¾-in. lump goes to a second section of approximately 8 ft. of 6½-in. round-hole screen plates, where the 6½x¾-in. coal is removed, leaving the 6½-in. lump to be discharged onto a 6-ft. apron loading boom. Two hand pickers remove the refuse from the 6½-in. lump; this refuse is carried to the mine-rock bin by a drag chain conveyor. All of the above equipment, with the exception of the ¾x0-in. slack conveyor, the Jouncer screens, and the 6½x¾-in. conveyor, was in use in the tipple prior to the installation of the cleaning plant. The 6½x¾-in. raw coal from the lump shaker is carried to the cleaning plant and elevated to the cleaning cone inlet by a 12x30-in. flight conveyor. On its way to the cone, the conveyor also picks up the ¾x¼-in. coal discharged from the Jouncer screens. Thus, the cone feed is composed of all the raw coal from 6½ in. down to ¼ in.

The design of the cone follows the



Arrangement of Equipment in the Powhatan Preparation Plant

same general design as the 10-ft. Mt. Union cones and the 12-ft. No. 8 cones. Clean coal floating at the top of the fluid mass in the cone is divided into two equal parts by a double-discharge chute and is delivered onto two 5x37-ft. desanding, dewatering, and sizing shakers. These shakers have top and bottom decks 4 ft. 9 in. and 5 ft. 9 in. wide, respectively. The cleaned coal is sized into 4x6½-in. egg, 2x4-in. egg, 1½x2-in. nut, and ¼x1½-in. pea; the first three sizes are carried back by flight conveyors to their respective loading tracks in the old tipple structure, where they are loaded into the cars by loading booms. Pea coal is carried forward to the first loading track under the washery on the forward section of the 2x4-in. egg conveyor and drops out into a chute and thence into the car before the egg coal enters the conveyor. Any free moisture remaining in the ¼x1½-in. pea coal is removed by Hendrick bronze, slotted drainage plates placed in the bottom of the chutes which carry the pea coal from the shakers to the flight conveyor and also in the pan of the conveyor which carries the pea coal about 15 ft. to its point of discharge into the chute and railroad car. Because of the fact that the original tipple was equipped with only three loading booms for the three prepared sizes, it was necessary to install a 24-in. belt-conveyor loading boom to load the washed 1½x2-in. nut coal on the former 1-in. slack track under the old tipple. It was not considered necessary to load the washed ¼x1½-in. over a loading boom, so provision was made for chuting it directly into the car.

Raw ¼x0-in. slack from the Jouncer screens is discharged onto an 18-in. reversible belt conveyor. When a ¼x1½-in. pea is desired, the ¼x0-in. fine coal is conveyed about 70 ft. up the pea loading track and there discharged into a 100-ton slack bin equipped with an air-operated slide gate for loading. By running the belt in the opposite direction, the ¼x0-in. fine coal is conveyed to a point where it can be loaded with the washed ¼x1½-in. pea as a 1½-in. slack, or it can be shunted into any one of the clean-coal flight conveyors and mixed with the washed prepared sizes in any desired percentage. By throwing gates in the chute which carries the washed pea coal from the shakers to the conveyor, pea can be discharged into any one of the conveyors carrying nut or egg coal. The 2x4-in. and 4x6½-in. egg conveyors and the 1½x2-in. nut conveyor each have slide gates over the 6½-in. lump and 4x6½-in. and 2x4-in. egg booms, so that mixed sizes can be loaded on any one of the loading tracks. This system of chutes, conveyors, and gates gives maximum flexibility with a minimum amount of machinery, and allows almost any combination of sizes to be loaded on almost any one of the loading tracks.

The refuse is discharged from the cone through a refuse draw of the free discharge type and, after dewatering and desanding, is delivered into an 8x16-in. refuse conveyor, which elevates it to a 60-ton refuse bin. This bin is also equipped with an air-operated slide gate to facilitate unloading. The automatic slate gate control on the cone is a duplicate of the satisfactory gear used at the No. 8 plant. Compressed air for operating both the cone slate gates and slate bin gates is supplied by a single-stage Ingersoll-Rand compressor. The cone control is electrical and employs standard General Electric Co. time relays and solenoid-operated air piston valves made by the John Eppler Machine Works. The timing of the cycle of the slate gate operation is under the control of the washery operator, who can start and stop the cycle by hand, as desired, or can push the automatic button and leave the timing to the relays. Automatic timing can easily be adjusted by the operator to suit conditions by changing the time elements of the relays.

The sand-and-water mixture reclaimed by the coal desanding shaker screens and the refuse desanding screens is carried by a trough to a standard 18-ft. sand sump fitted with an overflow around its entire circumference. Sand in the sand-and-water mixture flowing into the center of the sand sump quickly settles to the bottom of the sump, while the relatively clear water overflows the circumference and passes into the water reservoir. The highly concentrated mixture of sand and water is drawn off from the bottom of the sand sump by a 6-in. slow-speed Morris sand pump and is returned to the cleaning cone. Water is drawn from the water sump by a 10-in. Morris centrifugal pump and also is returned to the cone through the agitation nozzles and pipes. The sand sump is equipped with sludge-removal devices for use, at the discretion of the operator, when objectionable accumulations appear. Make-up sand is unloaded from railroad cars and stored in a concrete bin adjoining the washery building by a half-yard motor-operated grab bucket suspended from a trolley above the bin. Sand is added to the washery system through a chute into the refuse sand sump, the sand being

dumped into the chute by the grab bucket as desired.

Due to the proximity of the Ohio River, obtaining the required volume of make-up water offered no problem. However, any increase in the quantity used would entail higher pumping charges and add to the volume to be clarified before discharge into the river. For these reasons, the plant was designed to consume as little water as possible, with the result that the maximum make-up requirements are approximately 150 g.p.m. Because of the fact that the government would object to discharge into the river of black-colored water containing a large quantity of suspended matter, it was necessary to devise some cheap and reliable clarification method. As the Pittsburgh Terminal Coal Corporation had successfully solved the problem of a scarcity of clean, clear water by re-using the washery effluent after allowing it to filter through a mine-rock refuse bank, it was decided to employ the same general plan for clarifying the Powhatan washery water. A hollow near the river and about 200 ft. from the plant was converted into a settling pond by building a dam of washery waste (20 ft. high) across the lower end. The waste water flowing into the hollow is sharply reduced in velocity, with the result that the major part of the coarser suspended matter is dropped in the pond. The remaining suspended matter is removed as the water flows through the refuse dam, leaving a clear effluent for discharge into the river. When the basin is filled, the sediment will be loaded out by a locomotive crane equipped with a clamshell bucket.

The entire plant was constructed on a minor contract basis, the plans being made by H. M. Chance & Co., with the writer in charge of field correlation, design of make-up water supply, waste-water clarification, etc. The major part of the steel and machinery work was done by the Pittsburgh Engineering Foundry & Construction Co.; Heyl & Patterson, Inc., installed the Jouncer screens and the coal and slate shakers in the washery. Electrical work was done by the General Electric Co. and the sheeting was done by H. H. Robertson Co.

Plans were started in the middle of May, 1931, and the first steel was raised on Aug. 1, 1931. The first coal was put through the plant on Sept. 21, 1931, and full tonnage was handled on Sept. 23, 1931. Total over-all time for the design, drawing of plans, and construction of the plant was 18 weeks, including 7 weeks for erecting the steel and installing machinery. I have not been able to find that any other cleaning plant of such capacity was built and put into operation in less time.

The cleaning plant was designed to clean 300 tons of 6x¼-in. coal per hour out of a maximum hoist of 350 tons for the entire tipple. Since the Powhatan Mine operates on the double-shift basis, the maximum average output per day was to be 5,600 tons, of 2,800 tons per shift of eight hours. After the washery was put in operation, it was decided to wash coal up to 6½ instead of 6 in., which decision immediately increased the percentage of the total mine-run hoist going to the washery. The tipple input was gradually increased from 350 tons per hour until on Jan. 12, 1932, the tipple and washery handled 2,910 tons in 5 hours and 10 minutes actual operating time, an average of 563 tons per hour, of which the cleaning plant accounted for 450 tons. The above observed throughputs are much larger than could normally be expected from a 13½-ft. cone.

Operating results are given in the following table:

Size	Raw Coal: Ash, Per Cent	Raw Coal: Sulphur, Per Cent	Clean Coal: Ash, Per Cent	Clean Coal: Sulphur Per Cent	Reject, Per Cent
4x6½-in. egg	8.23	4.45	7.01	4.00	....
2x4-in. egg.	8.43	4.03	7.18	3.94	....
1½x2-in. nut	12.96	5.18	6.82	3.47	....
¼x1½-in. pea	11.44	4.58	7.18	3.52	....
Total....	.....	....	....	....	5.55
1½-in. slack*	10.91	4.37	7.80	3.83	....

*Consists of the washed ¼x1½-in. pea mixed with the unwashed ¼x0-in. fines.

It will be noted that in the majority of cases the results in actual operation bettered the preliminary figures for the cleaned product set up in the preceding table. In addition, this increased reduction in ash and sulphur was accomplished with a smaller total washery reject than the sink-and-float tests indicated.

Washery performance is checked continuously by a coal inspector, who runs a float-and-sink test on every car of washed coal loaded, using a mixture of carbon tetrachloride and gasoline at the specific gravity maintained in the washery; in this case, the gravity is 1.45, as the washery has operated at that figure since it was started. The inspector is furnished with blanks on which he must record the data for each car of washed coal, as well as the results of an hourly sink-and-float test on the washery refuse. A portion of the record for Feb. 2, 1932, is given in the table at the bottom of this page.

If the coal inspector gets two consecutive results showing more than 1.00 per cent sink in the washed coal, he speaks to the washery operator, who adjusts the gravity in the cone. It has been the experience of the Powhatan plant that once the specific gravity of the cone is established in the morning, it will remain uniform throughout the day, necessitating only one or two changes in the valve settings per shift.

A container of test mixture with a gravity of 1.50, or 0.05 higher than the gravity maintained in the cone, is kept on hand by the coal inspector for running an additional test on the sink in the washed coal where the initial test at 1.45 shows more than 1.00 per cent sink. Usually, it is found that the majority of the sink at 1.45 will float at 1.50. Similar tests are run on the float in the refuse where the results show more than 1.00 per cent. The refuse float is tested at 1.40, which is 0.05 below the washing gravity, and it usually is found that most of it sinks at that figure. This procedure gives the management a good check on the character of the material that is sink in the shipped product or float in the refuse. Ordinarily, the float in the refuse is almost entirely small particles of coal that have been broken from pieces of slate or band after leaving the cone.

The average consumption of sand per ton of coal washed compares favorably with the figure for the No. 8 plant of the Pittsburgh Terminal Coal Corporation. Over a period of several months, the quantity used has averaged three ½-yd. buckets per day

Inspector's Record, Feb. 2, 1932

Date	Car Initial	Car Type	Kind of Coal	Per Cent Sink	Washery Gravity	Per Cent Float, Refuse	Time Taken	Remarks
Feb. 2, 1932	PRR	Gondola	4 x6½-in. egg	0.22	1.45	....	....	....
Feb. 2, 1932	PRR	Hopper	2 x4 -in. egg	0.00	1.45	....	....	....
Feb. 2, 1932	PRR	Hopper	1½-2 -in. nut	0.54	1.45	0.86	8.00	Chippings in refuse float
Feb. 2, 1932	PRR (1½-in. Sl.)	Hopper	¼x1½-in. pea	0.63	1.45	....	....	Pea being mixed with slack
Feb. 2, 1932	PRR	Gondola	4 x6½-in. egg	0.05	1.45	....	....	....
Feb. 2, 1932	PRR	Hopper	2 x4 -in. egg	0.30	1.45	....	....	....
Feb. 2, 1932	PRR	Hopper	1½x2 -in. nut	0.43	1.45	0.42	9.00	....
Feb. 2, 1932	PRR (1½-in Sl.)	Hopper	¼x1½-in. pea	1.12	1.45	....	....	0.83 per cent float at 1.50

of two shifts. On the basis of a washed coal output of 3,600 tons and a total shipped tonnage of 4,500 per day, the sand consumption is 1.0 lb. per ton of washed coal, or 0.8 lb. per ton of total shipments. The Powhatan consumption is the lowest of any Chance sand-flotation plant of any type.

The total connected motor load in the washery is 352 hp. The washery when running light requires 247 hp., or 70.0 per cent of the connected capacity. At full load, the washery requirements total 332 hp., or 94.1 per cent of the connected horsepower. Power consumed per ton of coal washed is 1 kw.-hr.; consumption per ton of the total output of the plant is 0.8 kw.-hr.

Including two men per shift employed in picking the 6½-in. lump, the total operating force of the washery is as follows:

Foreman	1
Cone runner	1
Pump and slate gate attendant	1
General utility man	1
Coal inspector	1
Lump pickers	2
Total, one shift	7
Total, two shifts	14

The present cleaning force of 14 men for two shifts is a reduction of 22 men from the total previously employed in hand-picking and preparing a smaller total tonnage of fewer sizes, when, in addition, little was accomplished in cleaning nut and nothing was done to clean the pea coal.

Up to the present time, more than 350,000 tons of coal has been cleaned in the washery, so that the experience to date should be fairly representative of the average maintenance to be expected during the life of the plant. Replacements up to the middle of February were as shown in the table at the end of this article.

Up to the present time, no wear has been noticed on the casings and impellers of the 6- and 4-in. sand pumps. In the light of experience at the No. 8 plant, Diamite metal alloy was used in these parts, and it seems fairly certain that they will last out more than a year of continuous operation of the cleaning plant. The total cost of the replacements shown in the table below, including installation labor, was $1,550, or 5.1 mills per ton of coal washed (4.1 mills per ton of total production).

The shaker screens used at the Powhatan plant follow the No. 8 plant design in every particular. The clean coal shakers operate at 180 r.p.m., and the slate shakers operate at 200 r.p.m. Not a single drive arm or hanger board has been broken at the Powhatan plant, and no trouble of any kind has been encountered.

It is my opinion that the following costs will be approximated at the end of one year's operation of the Powhatan plant, these figures being based on observation of the operation of the plant to date:

	Cost Per Ton	
	Washed and Picked Coal	Total Mine Production
Operating labor	$0.013	$0.010
All maintenance, sand and supplies	0.010	0.008
Power	0.010	0.008
Total	$0.033	$0.026

The former method of preparation by hand-picking the 4½-in. lump, 2½x4½-in. egg. and 1x2½-in. nut entailed an operating cost for this hand-picking which, of course has been eliminated in the present plant, with the exception of the two pickers on the 6½-in. lump.

The total cost of the Powhatan plant, including all the necessary adjuncts, such as fresh water supply, changes in railroad tracks, new fine-coal screening equipment, slack bin and conveyor, new nut loading boom, etc., was approximately $230 per ton-hour of cleaning capacity.

Washed coal from the Powhatan plant has been on the market only a few months, but the response of the general coal-purchasing public to modern cleaning has enabled the Powhatan Mine to work a greater percentage of the available time than any other operation in the district.

Equipment Replacements at Powhatan Washery

Equipment	Replacements	Material
Coal shakers	4	⅜-in. round hole screen plates
Coal shakers	8	$\frac{5}{16}$-in. round hole screen plates (bronze)
Coal shakers	5	$\frac{3}{16}$-in. round hole screen plates (bronze)
Slate shakers	4	$\frac{3}{16}$-in. round hole screen plates (bronze)
6-in. sand pump	1	Cast-iron throat wear ring
4-in. sand pump	1	Cast-iron throat wear ring
Agitator	2	Bevels gears (accidentally broken)
Guides for refuse conveyors (wood)	4	Replaced when worn out

Powhatan Preparation Plant and Washery

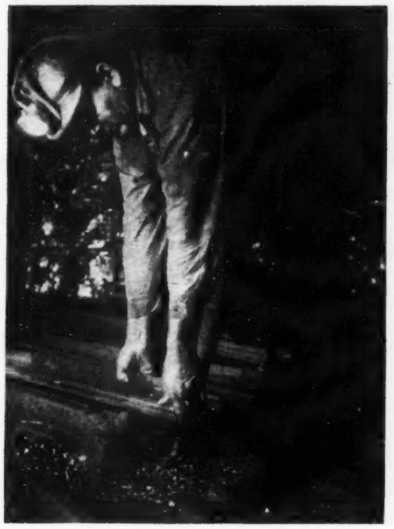
SAFEGUARDING

+ Head, Eye, and Foot

EFFORTS to educate and persuade mine workers to wear safety gear—protective hats, safety shoes, and goggles—are no mere gestures at the Valier mine of the Valier Coal Co., in southern Illinois. First instituted in the month of April, 1930, this measure has been made a definite part of the operating methods; so much so that records are kept to show whether at the incidence of an accident the victim or victim-to-be was equipped with and wearing the gear which would have prevented or mitigated hurt, see p. 206, this issue. The result has been a noticeable falling off of preventable accidents in the last two years which is expected to continue into the future.

From the time the first piece of protective gear was introduced until March 31, when operation ceased, pending a new working agreement, this plant, which is 100 per cent mechanized, produced 1,543,567 tons in 253 working days. During that period the plant ran on a reduced tonnage and irregular working schedule. So far as possible, work was divided among 637 workers. The average daily output during the period was about 6,100 tons and the number of men employed on any one day about 558.

Inasmuch as the plant was not on a regularized or normal operating schedule, it is impossible to fix the exact degree of safety provided by the protective gear on the basis of exposure and units of the gear used. The last count showed that 271 protective hats, 294 pairs of safety shoes and 238 pairs of goggles were in possession of workers, not including replacements of worn-out or damaged equipment.



Of the 637 men now on the payroll, 355 men, or 56 per cent, are equipped with one or more of the protective articles. And of this latter group, 48 men, or 14 per cent, are equipped with all three; 208 men, or 59 per cent, wear both safety shoes and protective hats; 294 men or 46 per cent wear safety shoes; 271 men, or 43 per cent, wear the protective hats; and 106, or 17 per cent, wear goggles.

For the last two years, the number of incidences reported of accidents to head, eye, and foot was 256. Of these, 52 involved the head, 138 the eyes, and 66 the toes. In this period 714 injuries of any kind whatsoever have been reported, and these were suffered by but 60 per cent of the total number of men on the payroll. Of the men in the injured group, 192 were injured but once and 86 of these wore no safety articles; 105 suffered two reportable injuries and 40 of these were unprotected; 46 were injured thrice and 16 of these wore neither protective hats nor safety shoes nor goggles; 36 were injured more than three times and 11 of these were unequipped with safety articles.

There has been a gradual decrease in the percentage of men not equipped with safety articles who have been injured more than once, showing that some men must be shown by personal experience before they will take advantage willingly of the protection the articles in question offer. After 192 men had been injured once, there occurred a drop in this group from a percentage of 45 to 37 of the total.

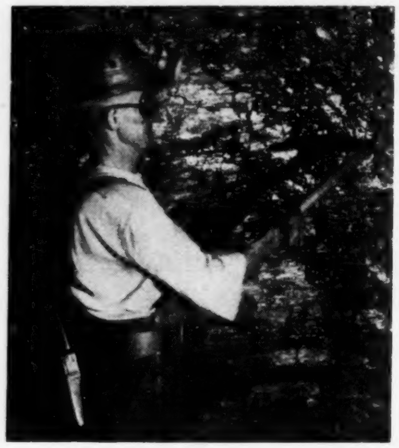
Many instances of how the protective hat or safety shoes or goggles have saved the wearer from temporary, partial or total disability, and even from death in a few cases, have been reported by the men themselves. But space here permits the recounting of only a few specific illustrations. In the machine shop a flying piece of steel shattered one lens of the goggles worn by an attendant at a lathe, but there was no injury to the eye. The caterpillar of a loading machine passed over the toes of a man wearing safety shoes, in another case a cutting machine, without injury to the foot in either instance. A jack pipe flew out, hitting a machine man on the protective hat he was wearing, caving it, but causing no injury to the individual. Other cases embrace immunity from more or less serious hurt to feet by falling chunks of coal and rails, to eyes by flying dust or larger particles, to head by falling coal or rock.

The protective gear is not, of course, advocated by the officials as offering absolute protection in every case merely because it does provide immunity in the majority of instances. If the blow or weight on a foot is centered on the cap in the toe of a safety shoe, the worst injury likely to occur is a contusion of the toes. But if the blow strikes glancingly and

passes over the proximals or shafts of the foot, broken bones may result.

Workers must purchase the safety shoes they wear. Protective hats, costing the company over two dollars apiece, are given gratis with the first pair of safety shoes to those who have need for head protection. Goggles are sold at half their cost to the company, so that the men are required to buy outright only the shoes, which cost somewhat more than a serviceable pair of ordinary working shoes, but are worth the difference.

Two styles of shoes are made available, a leather-soled, lightweight shoe (2 lb. 8 oz. to the pair in size $8\frac{1}{2}$), which is preferred by the surface workers, and for underground workers a heavy service shoe with composition sole, weighing 3 lb. 3 oz. to



the pair in size $8\frac{1}{2}$. The average life of this last shoe without resoling is about 30 days. Some men have given their shoes a third resoling. Payment for the shoes is arranged by checkoff at the rate of 50c. per pay. Though but 294 pairs of safety shoes were worn on the last operating day in the period, 453 pairs had been sold.

Three types of goggles are offered: (1) A ventilated goggle with non-shatterable lens for use in the shops and by motormen underground; (2) a copper-wire screen goggle for face use, chiefly for pick work; and (3) a non-shatterable lens with a solid rubber, non-ventilated mounting for use in an atmosphere heavily iadened with dust, as during the application of rock dust. Face bosses carry one pair each of glass and screen goggles which they lend to men who ordinarily would have no need for them except on jobs outside their usual routine.

▼ ▼ ▼

What Constitutes Fair Depletion?

(Continued from page 192)

terest—In this case the calculation is based on the idea that a certain number of acres will remain unmined during the entire life of the mine, that others will be mined out immediately, and that the remainder will have lives of intermediate length.

It is argued by those favoring this method that the value of the coal increases with the progress of time and that, therefore, the annual items, from which the summation is made should increase by geometrical progression, beginning with $1+i$, which is the first item, and ending with $(1+i)^n$ which is the last item. Let $(1+i)=R$. Then according to the regular formula where the first term $f=R$:

$$S=\frac{R^{n+1}-R}{R+1}=\frac{(1+i)^{n+1}-(1+i)}{(1+i)-1}$$

Where S = sum of annual charges for one dollar invested

Now

$$M=\frac{P}{G}\times\frac{S}{N}=\frac{P}{G}\times\frac{(1+i)^{n+1}-(1+i)}{iN}$$

Substituting

$$M=\frac{1,000}{9,000}\times\frac{(1.08)^{31}-1.08}{0.08\times 30}$$
$$=0.11111\times 4.0782=\$0.453 \text{ or } 45.3\text{c.}$$

This method runs contrary to the views of many authorities, who hold that the coal which will not be brought into the market until a distant date should not have the value of the coal that comes into the market earlier. According to their views, as most of the coal comes in at a later date, the value of the coal should decrease rather than increase.

(4) Sinking Fund to Amortize at the Close of the Life of the Mine the Entire Value of the Coal as Increased by Compound Interest—In this method of calculation the principle recognized is that the original price is allowed to stand, with the accumulated compound interest, and must be recovered by the depletion reserve consisting of annual deposits drawing interest compounded annually. This formula may be set up as follows:

$$M=A\ P\ (1+i)^{30}\times\frac{r}{(1+r)^{30}-1}\div C$$

where

$i=8$ per cent $=0.08$, and $r=4$ per cent $=0.04$

Substituting,

$$M=\frac{5,000\times 1,000}{1,500,000}\times(1.08)^{30}\times\frac{0.04}{(1.04)^{30}-1}$$
$$=3.333\times 10.63\times 0.01783$$
$$=\$0.598 \text{ or } 59.80\text{c.}$$

(5) Sinking Fund Equal to the Value of the Coal Mined as Determined by Taking the Original Value and Adding Compound Interest for Half the Life of the Field—This is not a true formula, for by taking the compound interest table and using years for abscissas and corresponding interests as ordinates, a curve is obtained, whereas the following formula treats the line as straight; but as every one of the foregoing formulas are predicated on a guess as to what will happen in the future, the fact that this is an approximation makes it no less useful, and it is simple. Thus:

$$M=\frac{P\,(1+i)^{\frac{n}{2}}}{G}$$
$$=\frac{1,000\,(1.08)^{15}}{9,000}=0.1111\times 3.1722$$
$$=\$0.3524, \text{ or } 35.24\text{c.}$$

Suppose that only the first cost was taken—namely, \$5,000,000—and assuming that 3 per cent compounded annually would be a safe interest rate for the sinking fund, a yearly amount, D, for deposit should be set up according to the formula:

$$D=\frac{r}{(1+r)^n-1}\times \text{First Cost}$$

Substituting

$$D=\frac{0.03}{(1.03)^{30}-1}\times 5,000,000=\$105,100$$

This would mean charging for depletion only 7c. per ton on a million and a half tons annual production, and would let the stockholders wait 30 years for the return of their money. Obviously, the stockholder would rather have his money returned annually on the basis of the actual cost in the ground; \$5,000,000 divided by 45,000,000 tons, or 11c. per ton. In accordance with the recommendation of the A.I.M.E. committee, these distributions would be liquidating dividends and not taxable income.

Why Steel Mine Cars

By DONALD D. LONG
Woodward, Ala.

IN earlier days probably one of the pithiest of the many bones of contention in the coal mining industry was the use of steel mine cars. The pros and cons were, and some still are, at once serious, humorous, trivial, and pathetic.

At the outset, it must be conceded by the wooden-car advocates that the manufacturers of steel mine cars have vastly improved their product, and by the backers of the steel car that the builders still have some minor changes to make in their product. The greatest prejudice is that based on the experience with the first series of cars, which, it must be admitted, were grievously lacking in many of the points that enter into the structure of the efficient car. In the first place, the cars were too heavy and too hard to handle; the strength was not in the frame, where the strength should be; they were improperly bearinged. After wrecking once or twice the cars had to be completely dismantled and and refabricated.

Now let's see what has been done to convert this earlier mining mistake into a tool for efficient production. The frame has been greatly strengthened. Points of greatest stress have been bolstered by the use of better materials and better workmanship. Thus the old argument that, after a couple of wrecks, the steel car was ready for the burner's torch, has been buried quite dead in the graveyard of other lifeless arguments. The composite experience of a number of mine operators have proved that a wreck of sufficient intensity to warp a steel car would completely demolish a wooden one. A dent in the side of a steel car isn't nearly so serious as a broken board in the side of a wooden car.

*Mr. Long, who was connected with the Woodward Iron Co., died as the result of an accident Sept. 25, 1931.

Then, too, the mine operators suddenly became aware of the fact that their steel cars of the early vintages were being warped by continual wrecking. They asked themselves the reason for so many wrecks. And the answer came back: "Because of poor track—improperly kept haulways."

Blame the car for wrecking? Not your progressive operator: He went to the source of the wreck and discovered that the twisting of his steel cars was but one of the net results of the wreck. His production was cut down; his costs were less; his profits decreased. It must be admitted, even by the worst of us, that the advent of better cars forced our attention in the direction of better track and haulageways for our mines. With efficient cars, good tracks, and properly maintained haulageways, our transportation problem was solved.

Steel cars are too heavy and too hard to push. But are they? Let's see, now. When equipped with anti-friction bearings the steel car weighing 50 per cent more than the wooden car is just 50 per cent easier to push. Now, all you anti-steel car men jump up and holler, "Why not the same bearings on wooden cars, as some of us are doing? We get the advantage of lightness and easy rolling." That's a good idea, as far as it goes. Why, then, not use a 16-cylinder engine in a bantam Austin frame? You would have the easy handling advantages of a light car and a powerful motor.

Obvious, isn't it? Why go to the expense of equipping a wooden car with bearings that are too good for it? The life of your wooden car is, perhaps, five years. This doesn't mean that it has to be repaired every five years, but replaced. That is the experience of several mines whose records have been made available.

The life of your steel mine car, with proper care—and proper care should include occasional painting to keep the rust from getting the better of the body, attention to lubrication and tightening of rivets and nuts when required—will be from ten to twenty years. The ten-year estimate is the lowest and twenty years is the highest expectancy of life given by the mine operator.

A group of representative figures from a number of mining operations shows that in the course of the lifetime of a wooden car—that is, five years—the repairs will equal the original cost. This is exclusive of the minor repairs made inside the mines; nor does it cover lubrication.

Consider the carrying capacity of the steel car as compared to the wooden type. With the same over-all dimensions it is possible to load at least 20 per cent more into the steel car than the wooden car. This one feature is a sufficient reason for the use of the steel car. Figures from a representative group of users of steel mine cars give the repair cost per ton, or perhaps we should say the mine car costs per ton, as 28 per cent less than for wooden ones. This is no small item in any man's mine.

Many of us have equipped with roller bearings the motors that have any appreciable amount of starting and stopping to do. We see pictures of three men pulling the giant locomotives with a pull cord. Isn't it obvious that the same savings in power are effected when good bearings are installed in the equipment to be hauled?

Naturally, no time or space has here been given to the mutterings of the anti-steel mine-car man. They have had their day and it appears that lack of sufficient urging or the general retrenchment policy of some organizations in our industry during the present time is the only reason the entire bituminous production body has not swung to the steel car.

Coal Age

Sydney A. Hale, *Editor*

New York, May, 1932

Make it somebody's job

IN too many of the smaller companies safety is everybody's job, and that job is never done. Success will never be attained till someone is appointed to give safety his special attention, thought, and service—to hold it as his first and only duty, not be merely an afterthought. Certain economic obligations thrust themselves irresistibly into view, but safely hides itself more modestly till someone is hurt or killed, and then it lies by till another similar misfortune, because the accident has happened and it is too late to do anything about it. Safety, if it is to be, must have an advocate, a representative, a voice. Somebody must be on hand to organize for safety, to crystallize sentiment regarding it, to urge the safe way, to talk safety on every occasion.

Everybody cannot be expected to specialize on safety, attend the meetings of national safety organizations, inquire diligently into accidents, and find their more remote causes. The work must be delegated or it will not be done. One company with a 2,000-ton-a-day mine has a safety engineer. He is getting results because it is his job. He thinks safety all his working hours; every detail to him has a safety slant; his conversation is about safety, and safety accordingly is not forgotten, for he is safety's advertiser and service man.

Where will it end?

ADVOCATES of a new invasion into the domain of private business quite frequently—and honestly, too—seek to disarm opposition by stressing the idea that their proposals involve a minimum of interference with the freedom of individual action. Proponents of current proposals to regulate the bituminous coal industry are no exception. "Let me make it clear," declared Senator Davis in an address before the Chamber of Commerce of Somerset, Pennsylvania, last month, "that this bill [the Davis-Kelly bill] does not contemplate any arbitrary governmental interference with the industry. Industrial self-government is preserved."

The implications of such persuasive promises, however, seldom are substantiated in actual practice. Testimony of opponents of the Davis-Kelly bill, for example, demonstrates conclusively that the attainment of the professedly underlying objects of that measure would be impossible without a degree of interference which would destroy completely the industrial self-government that the Senator declares his bill would preserve. As the history of railroad regulation shows, once supervision is started, it grows and grows until no man can say where and when it will end.

In defense of this interference, of course, the proponents of legislation raise the cry that the industry has done nothing to correct its own economic instability. Such correction, as those who have studied the situation know, is not as easy in performance as in statement. But there has never been a period in the present generation in which the bituminous industry as a whole has displayed a greater willingness and earnestness in attempting to work out a solution of its own complexities. Why, then, should not those who declare they turn to government control only as a last resort give the industry at least a fighting chance to accomplish its own rehabilitation?

Freeing mines from gas

STUDIES made by J. Ivon Graham have confirmed the great power of anthracite to absorb methane. Thus, at 30 deg. C. the dried durain, or dense coal, from the Barnsley bituminous seam that had passed through a 200-mesh screen took up only 184 c.c. per 100 grams, whereas anthracite dust that passed through such a screen and contained 0.2 per cent water took up 375 c.c. This quality of "sorbing" gas, whether methane, oxygen or any other, is what makes anthracite such an excellent material for purifying water and sewage.

When gas forms in the heart of a piece of coal, it holds that gas with great tenacity. Mr. Graham found that a piece of coal exposed to the atmosphere for 40 years still contained one-fifth of the gas which it contained when it was freshly mined. It is this fact that makes dangerous a sudden crushing of acres of coal, such as occurred at the Woodward Colliery and described in this issue.

A mine, however well ventilated, is unable to carry away the large quantity of gas thus suddenly liberated. Such a case is likely also to liberate the bodies of gas held in roof crevices. In fact, it is thought that these crevices explain in part why a lowering of barometric pressure causes an outflow of gas. These crevices, where they have leaders extending into the open portions of the mine, have gas that is at low pressure, and on a lowering of the barometric head they respond rapidly to the change in pressure and discharge into the mine. The gas in the coal is more tightly held than that in such fissures, and changes of atmospheric pressure of an inch or more can have little effect on the volume of discharge. Of course, unventilated gobs are even more readily evacuated with every decline in pressure, and where many abandoned and unventilated rooms exist, a decrease in water gage is bound to be followed by an increase in the methane percentage of the mine air.

A system of complete extraction, with immediate

backfilling of the excavated area, would solve many of the ventilation problems, but not by any means all, for there must be always a little weighting while the roof is settling on the backfilling, and the stowed material, if placed dry or allowed to become dry, will contain crevices of large aggregate volume, which, however, will respond less readily to changes of pressure than accumulations of gas in rooms still standing. Backfilling of carbonaceous material is likely to emit its own quota of methane, and when crushing occurs even more than that quota, because a crushed backfilling will liberate a large quantity of methane much as will a crushed pillar. The collapse of roof being sectional and not over a large area will, however, spread the methane emission over a longer period.

Leakage of air near fan

WHENEVER a positive pressure is put on air by the whirling blades of a fan, the air endeavors to escape and, if any part of the intake is creviced, much air will be lost. Similarly, if the fan is an exhaust, the greater pressure of the atmosphere will force air through crevices into the drift, slope or shaft, where it will pass to the fan, increasing the work to be performed. Furthermore, because the differences of pressure between intake and return are greatest near the fan, the likelihood of leakage is greater at this location than at any other point within the mine. So greater care should be taken here than elsewhere to provide adequate pillars and stoppings, reinforced by cement mortar, the last because, unless the measures are plastered with cement, air will leak through roof, floor and pillars, at least far enough to bypass the stopping. Doors at such plants are peculiarly wasteful and to be avoided.

These observations apply both to drifts and shafts. Rock often has crevices; that is why water leaks into the mine. Where a threadlike stream of water visibly trickles through earth, rock or coal, an invisible stream of air may be expected to pass by the same channel when water no longer fills the crevices. If rock in drifts and shafts is ill-supported, these crevices will open and other cracks be made. Timbers will alleviate the situation, but unless the spaces behind the lagging are tightly packed, the original airtightness will not be preserved. All that timbering, lagging and packing will do, however, is to maintain original conditions; in any event, crevices are sure to exist, some due to original fractures and solution channels and others to cracks made by strains prior to timbering, by weight or by blasting.

Resistance to air travel through such adventitious channels per foot of traveled distance may be, and doubtless always is, out of proportion to the resistance of the mine, but the shortness of travel often compensates for the constriction and irregularity of these passages and their high specific resistance. Consequently, every effort should be exerted to find and correct such losses, remembering that the power used by a fan must vary as the cube of the volume of the air it delivers under any given set of conditions, provided the fan operates with equal efficiency at all speeds. In one instance, 40 per cent of the total quantity of air passing through the ventilator, instead of going into the mine was escaping from the perimeter of an unlined shaft. By stopping these leaks, 10 hp. out of the 62 hp. which the fan was using was saved, a reduction in power cost of about $100 a month.

The leakage in this case doubtless was unusually large, but in every fanway there is some leakage, and careful inspection may reveal that it is of vital importance. But as it occurs over a large area, it usually is not readily observable, so its quantity should be determined by ascertaining the difference between the quantity delivered by the fan and the quantity received at some near-by point within the mine. Even where all evidences fail, it pays to guard against the possibility of such leakage by workmanlike construction, the proper use of tight filling behind supports in fractured ground, and a generous use of cement.

Misdirected philanthropy

WHETHER it is possible to sell mine-run bituminous coal as low as $1 per ton and recover direct costs, overhead, fixed charges, and a decent return to the capital and the labor employed in its production, even in these days of low wages, is, to say the least, open to question. That 80 cents will be sufficient taxes credulity. And yet, bids for the fuel supply of the New Haven Railroad, made public a few weeks ago, show tenders of over 20,000,000 tons at $1 or less and tenders of over 3,000,000 tons at 80 cents or less, with 1,200,000 tons offered at 70 cents and less.

If the folly of ridiculous prices could be visited solely upon their makers, the results might be viewed with equanimity. Such actions, however, establish a fictitious level of values which depresses the entire industrial price structure. Consumers paying reasonable prices naturally ask why they should be penalized and their competitors made the objects of the coal man's philanthropy.

Coming when the whole question of railroad fuel purchases is a subject of official investigation, this avariciousness for tonnage at any price at all is doubly unfortunate. Because most railroad managements in recent years have endeavored to take a broad view of their relationships with the coal industry, they already are suspected by critics who do not seem to have a clear picture of economic interdependencies in the promotion of genuine prosperity. Indefensibly low bids make their position more difficult in a time when every agency in coal production and selling should be cooperating to elevate industrial fuel prices to a fair level.

NOTES

. . . from Across the Sea

SCRAPER LOADING is not altogether an innovation. W. F. Masterton in a paper read before the East of Scotland Mining Students' Association in Heriot-Watt College, Edinburgh, Scotland, declared recently that it had been envisioned in the "slipe," a sheet-iron plate turned up at the back with a handle in front with a rectangular wooden frame, or "cape," around its edge which converted it into a box, into which the coal was shoveled. It held about 224 lb. and was pulled along the face to the heading, where it was dumped at the roadhead into mine cars. By this contrivance it was possible to put the headings further apart in longwall where the coal was only 24 in. thick. This equipment was used 40 years ago in Scotland and perhaps at an earlier date. By its means it was possible to avoid having to cast the coal and shovel it a second time, a difficult operation in a thin seam.

In a French mine, a semicircular iron trough 5 ft. long and of 20 in. diameter was introduced for the same purpose. It skidded along the face on light narrow-gage rails which acted as guides to direct its movement. The loader at the roadhead pulled the trough and its load out of the working face by a rope attached at the front end and, after it was emptied, the miner at the other end pulled it back to the point where he could load it. With this means of transporting the coal, the length of face in a 24-in. seam could be increased without difficulty from 50 ft. to 100 ft., thus halving the cost of brushing. The trough also was used to convey rock for stowing from the brushing into the face. About this time the Blackett conveyor, shaking and belt conveyors came into use, which, being more efficient, displaced these earlier types.

The Ritchie conveyor, which apparently much resembled one in use at the Colonial mine of the Madeira Hill & Co., at Natalie, near Frackville, Pa., consisted of a belt 75 ft. long pulled back and forth along the face in steel troughing, which acted as a guide. To operate the conveyor, a main-and-tail rope haulage hoist was provided. In filling cars the belt was pulled along in the troughs until it reached the main drum on which it was wound, causing the coal to fall over the drum into the car. The Thompson conveyor consisted of a train of troughs, or slipes, connected together and pulled back and forward by a main-and-tail rope haulage. The loaded troughs skidded along the floor of the mine and passed over a bridge at the roadhead, where a plow diverted the coal into the cars beneath it.

The scraper in Great Britain leads a quiet life, sliding gently along guard rails placed against a row of props. It does not invade the face and tear the shattered coal from the longwall. It gathers up some coal that has fallen in its path, but largely it gathers coal pulled, pushed, or shoveled in front of it. No wonder it has been said, "Why flare the shovel mouth?" A rectangular shovel will slide more tamely on the guides. So the Becander scraper conveyor has been devised—it looks like a bottomless and topless rectangular steel box with the front end removed and replaced by a broad slat or bar over the top to which the chains are attached.

Mr. Masterton says that the scraper has the following advantages: (1) Coal need not be lifted but merely pushed into the track of the scraper; (2) conveyor is noiseless and so does not increase the dangers of loading; (3) shifting is easy and coal output is large; (4) where coal is undercut in the clay the workman can throw the cuttings into the gob with minimum exertion, no conveyor being in the way; (5) undulations and faults do not interfere with its operation; (6) face can readily be swung in any direction; (7) cost is low; (8) falls of roof do little damage to the equipment and occasion little loss. Mr. Masterton also draws attention to the fact that scrapers should not be used with a heaving pavement and that they are not so serviceable in thick seams as in thin.

GERMAN mines have been using locomotives having boilers filled at stations with steam under pressure. These they term fuelless locomotives. At one mine at least in the United States, standard locomotives built with coal grates for regular service but charged with boiling water from a steam-generating station have been used for hauling cars to and from the tipple and for spotting them under the chutes. They have given, I am told, excellent satisfaction. Locomotives built for fuelless operation (*feuerlose lokomotive*) have been used in Germany in the big brown-coal pits of that country. The illustration, herewith shows one which has a cruising radius of about 31 miles. The locomotive can be charged in from 12 to 15 minutes. The pressure of the steam, as delivered to the tank which replaces the boiler, is 515 lb. The length of the locomotive is about 27 ft., and the boiler capacity is 6,286 cu.ft. The locomotive has a weight of 48 tons and a tractive force of over 10 tons. With one of the locomotives, a fully loaded tram can be driven at a speed of 25 miles per hour. The operation is not only fuelless but inexpensive, the steam being generated under most favorable conditions. Smaller locomotives than these are being used underground; where, however, the escape of steam and the heat of the locomotive would have some disadvantages. These units are replacing electric and diesel units.

ONE would imagine that the worst already had been said, and said again, about corrosion of mine pipe lines and the like, but here is a new and perhaps important, slant. N. Simpkin, at a meeting of the Manchester Geological and Mining Society, related an instance in which a fireboss, with an ordinary safety lamp fitted with 20-mesh-to-the-inch gauze, ignited the atmosphere escaping from a steel pipe line.

It was evident that the pipe was filled with a gas burning at a high temperature, or the safety lamp would not have ignited it. No water was coming from the pipe at the time. A reddish or orange flame, 5 ft. long, was projected from the end of the pipe as soon as the lamp came in front and within a foot or two of the orifice. It was thought the gas was hydrogen. The strange color might have been due to the presence of iron rust or ferrous or ferric hydrate dust in the pipe atmosphere. Another similar inflammation occurred some time later. Workmen reported that, when making repairs on the line, they had

Locomotives Filled With Live Steam Pull Trains of Cars for Brown-Coal Mines in Germany

noted a peculiar "carbide" smell. But this again is hardly characteristic of hydrogen.

However, it is said that on tapping holes in the pipe, and on inserting a long narrow pipe into the line, samples were obtained that showed the presence of a quantity of combustible gas, the atmosphere analyzing in one case 11.1 per cent hydrogen, and in another case 67.4 per cent hydrogen.

Because of the danger of the escape of hydrogen from such a pipe, the company decided to use a bitumen-lined pipe instead of one of steel. Lime was added to the water for neutralization purposes, but, as the author remarked, this would be an expensive way of reducing the acidity of any large quantity of water. In order to avoid discharging the water into the sump, thus discharging "hydrogen" into the sump area, arrangements were made to deliver it direct to a tank from which the pumps, delivering the water to the surface, drew. Apparently this tank did not have free access to the mine air. Fortunately, even before this change, a plentiful supply of air swept past the end of the pipe, so that the danger of an explosion was greatly decreased.

However, the question arises whether corrosion or, for that matter, electrolysis of steel of all kinds, either arising from a natural battery action or from return currents, does or does not introduce an explosion hazard into mines. Hydrogen is not a gas against which the safety lamp is an adequate protection. It burns in both low and high concentrations, and the question of its presence in mines, and its effect in causing gas explosions, is one which immediately arises as a possibility from a consideration of this occurrence.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Proceedings of the Third International Conference on Bituminous Coal. 2 vols., 1,999 pp., 6x9½ in.; cloth. Carnegie Institute of Technology, Pittsburgh, Pa. Price, $15.

So many subjects were treated at the Third International Conference on Bituminous Coal that anyone interested in the coal industry could not fail to derive from it information of great value. The broad range treated included economics, competition between fuels, low-temperature and high-temperature carbonization, coal-carbonization problems, gasification, byproducts, hydrogenation and liquefaction, railroad and steamship fuel, domestic utilization of fuel, power-plant fuel, pulverized fuel, smoke-and-dust abatement, preparation, coal-cleaning, origin and classification and steam purification.

Though only two of the sessions dealt with producing problems—preparation and coal cleaning—all were concerned with those matters which influence the merchandising and the use of coal, which are matters of vital interest to every coal man. These are subjects he has too long neglected, but must now be considered if coal is to continue to be a successful industry. They were discussed by men from many countries —Belgium, France, Germany, Great Britain, Holland, Italy, Roumania, Russia, South Africa, Spain, Sweden, and the United States—accordingly the two volumes contain much of the latest information on the progress being made throughout the world in the economic utilization of coal.

Accidents From Hand and Mechanical Loading in Some Illinois Coal Mines, by A. C. Callen and C. M. Smith, Illinois Coal Mining Investigations Cooperative Agreement, University of Illinois, Bulletin No. 231. 43 pp., 6x9 in.; paper. Price, 25c.

That much discussed subject, the relative safety of coal mines from accidents incident to face operations using mechanical, pit-car and hand-loading methods respectively receives elucidation in this monograph. One mine in the operation of its pit-car loaders reduced its lost-time accidents per 100,000 tons produced 29.0 per cent; its days lost per 100,000 tons, 45.6 per cent. As to exposure, it also reduced its lost-time accidents per 100,000 man-hours 6.1 per cent; its days lost per 100,000 man-hours, 28.6 per cent; and its days lost per lost-time accident, 24.4 per cent. It had no fatalities from the operation of pit-car or hand loading.

For the pit-car group as a whole, however, the record was less favorable. Seven mines in this class reduced lost-time accidents per 100,000 tons, 15.3 per cent; increased days lost per 100,000 tons, 26.8 per cent; increased lost-time accidents per 100,000 man-hours, 16.8 per cent; increased days lost per 100,000 man-hours, 80.7 per cent; and increased days lost per lost-time accident, 57.8 per cent.

Full mechanical loading, in the fewer mines using it, three in all, showed better results. By the use of mechanical loaders, one mine reduced all its accident records by whatever method of count they are measured and did it by large percentage figures: Lost-time accidents per 100,000 man-hours were reduced 57.8 per cent and days lost per 100,000 man-hours by 77.2 per cent. The average reduction for lost-time accidents per 100,000 tons at the three mines was 83.1 per cent; for days lost per 100,000 tons, 74.1 per cent; and for lost-time accidents per 100,000 man-hours, 21.3 per cent; but the days lost per 100,000 man-hours increased 21.0 per cent and the days lost per lost-time accident increased 54.3 per cent.

The monograph records studies also into the classes of accident due to mechanized loading and as to the parts of the body injured in pit-car loading. In all instances falls of coal or rock lead in frequency and nearly always in severity also. The bulletin draws attention to the fact that in a mine which it designates as Mine D, the frequency rate has decreased 0.56 per cent of a lost-time accident per 100,000 tons each month or 1.0 lost-time accident per 100,000 man-hours per month—a very evident proof of progress. However, most other mines showed no trends, and none was as marked as in Mine D. Nevertheless, what some have done, all may eventually do. If the good results of the best should be made general, the record would fulfill the hopes of the industry. R. D. HALL.

* * *

Ding Goes to Russia, by J. N. Darling. Whittlesey House, McGraw-Hill Book Co., New York City. Pp. 195, 6x9 in. Price, $2.50.

So much has been written on the Russian experiment in terms of production, sociology, five-year plans in four, quotas, tractors, and the new revolution that it is refreshing to turn from these heavy, usually argumentative, tomes to a volume which is concerned primarily with the Russians as individuals. J. N. Darling, known to millions of American newspaper readers through the cartoons signed "Ding," decided to see Russia for himself last summer as an ordinary tourist from the Middle West, and his impressions are embodied in this book.

Those who are convinced, without having been there, that Russia is a new Eden where only perfection reigns will not like Ding's book. And those who are convinced that Russia is a new hell on earth, menacing all that is sacred and good in civilization, doubtless will be horrified that a sturdy son of Iowa could become so incarnadined by casual contact with the Bolshevist menace. But the rest of us, somewhat wearied perhaps with the attempts of one school to idealize and of another to demonize the Russian, will get a clearer picture of what is going on by Ding's restoration of the Russian as a human being than we might from dizzy columns of statistics and propaganda. And we will actually enjoy reading the book.

THE BOSSES TALK IT OVER

Stopping Tool Stealing

"What's wrong, Mac," inquired the super on encountering his foreman striding toward the office as if he was out to get somebody. "Is it internal heat or just the sun?"

"Worse," was the laconic reply of the foreman. "Some blankety-blank scoundrels are taking tools from where they aren't lost. Our loading-machine crews can't keep a set of tools a week, and the situation is even worse than that with crews that work on machines that are double-shifted. I'll get those snitchers yet, and when I do——"

"Easy now, Mac. Don't overdo yourself. You can't solve the problem that way. Why don't you figure out some system to stop the stealing?"

"Hell! We've tried everything we could think of. Tool boxes under lock and key are broken into. We tried charging the crew with the tools issued to them, but that didn't work. What next, Jim? Maybe you can figure out a way."

WHAT IS YOUR SCHEME?

1. Who should furnish the tools used in the operation of loading equipment—the men or the company?

2. Should the men be charged for the tools that are lost or stolen if the company provides them?

3. Should each crew have its own set of tools if the loading unit is double-shifted?

4. What alternative would you suggest, if any?

All superintendents, foremen, electrical and mechanical men are urged to discuss these questions. Acceptable letters will be paid for

Should rehabilitation of the injured be forced by law on the owner of the plant where the injury occurred? Jim said, "No." Mac said. "Yes." What the readers say is told in the letters following:

Education and Mine Safety

I am inclined to take the position Mac takes in regard to the reemployment of the man Brown, who lost an eye while in the employ of the company. It is no more than right that he should be given employment, for he has a living to make even though he has lost an eye, and in all probability he was doing his work as directed.

In many coal mines today safety is the watchword so long as it costs nothing, but just let it appear that there is going to be some financial outlay and there is a different interpretation of the meaning of safety. Yet, if consideration be given to the costs that are involved in cases where the true meaning of safety is not taught to the employees, then another angle of the subject will be involved that will open the eyes of the employer to the fact that he is following a losing game in not getting behind the movement with his influence.

Safety in the true sense will mean a lesser number of men thrown out in the world, maimed, disfigured and handicapped in the performance of their daily labor by the loss of some member of their body or from some ailment brought on by some accident incurred while performing some task assigned them by a foreman without giving them any instructions as to how to perform that task with safety. And while they cannot now perform the work as speedily as formerly, neither can they perform it with as little discomfort to themselves, and while this may add to the cost of production, is there any reason why these men should be thrown in the discard when they have given their best to the industry in the endeavor to not only make a living for themselves and their families, but to make their employers' investments a profitable one.

Would it not be more profitable even in these times of distress, when many coal companies are operating on a small margin of profit or perhaps without profit, to assess a small tax, if we may call it that, on each ton of coal produced. Place this money in a safety fund at each mine and use it in teaching the employees how better to protect themselves in the performance of their work and at the same time not reduce the amount of labor performed in a given number of hours. I feel sure that this would result in a lower cost per ton in the run of months by reduction of lost-time accidents, and in a large reduction in the number of crippled men in the mining industry.

Many miners of today have not had the advantage of an education. Consequently their minds are not trained to function as quickly as many of us who have received an education and who have trained our minds to think and act quickly when called upon to do so. Those with a trained mind can many times perform a dangerous piece of work with safety while those with the untrained mind may be seriously injured or killed in doing so, because their powers to think and act are slower. It is evidently up to the employer to see that these men are educated in the performance of work.

Sullivan, Ind. JAMES A. RUSSELL.

There Is One Good System

In a belated reading of my February copy of *Coal Age*, my attention was arrested by the "Bosses" query in connection with the cribbing of cars. As set out, the problem seems highly improbable in this day of diminished pay checks. Otherwise it is a sad commentary on the intelligence of the average mine worker, particularly so when applied to an entire district. Car cribbing, when loading is on a tonnage basis, pays the loader *only* under a restricted empty car supply. To anyone familiar with the business end of a scoop shovel, it is only too evident that cribbing has a tendency to delay car movements, but if there should be a slight delay in car movements from the face, cribbing is a factor which should not be overlooked, and to the loader should prove an increased source of revenue. However, cribbing can be overdone. I have known many loaders who have taken an especial pride in car cribbing, only in many cases to be sadly disillusioned when checking the weight sheet. Careless switching by motormen in most cases causes spillage to cars which when leaving the face loaded looked like perfect workmanship.

There is one system which could be adopted in the case cited, and that is to prepare a simple average pay sheet, showing the number of cars loaded by separate tallies, and the tonnage for the day's loading, followed by the approximate earnings of each tally per day. This sheet should be posted daily, thus:

Date	Tally No.	Cars loaded	Tons	Earnings
	1	10	20	$8.64
	2	10	19	8.21

Here are naked facts presented for the benefit of the Bill Smiths which will give the face foreman a chance to attend to supervision duties with a certain sense of security. There can be nothing gained in constantly finding fault with an assistant. If the system of checking *causes* has not been followed, only too often the man with the chip on his shoulder has allowed his vision to be dimmed by effect. Paying by the car is obsolete. It leaves too many avenues open for argument. Better by far to pay by day wage and inflict graded fines for light loadings. Honest effort must be rewarded.

Princeton, B. C. JOHN BENNETT.

Recent Patents

Mine Car; 1,825,850. Edgar H. Bostock, Nutley, N. J. Oct. 6, 1931.

Mine Car; 1,825,943. Thomas R. Evans, Petros, Tenn. Oct. 6, 1931.

Mining Apparatus; 1,826,218. Charles F. Osgood, Clarement, N. H., assignor to Sullivan Machinery Co., Chicago. Oct. 6, 1931.

Blasting Cartridge and Tamper; 1,826,-150. Erle Ormsby, St. Louis, Mo., assignor to Central Mine Equipment Co., St. Louis, Mo. Oct. 6, 1931.

Apparatus for Carbonizing Coal; 1,826,-573. Richard L. Rodgers, Chicago, assignor to Charcolite Corporation, Clinton, Ind. Oct. 6, 1931.

Blasting Cartridge; 1,826,702. Frank H. Armstrong, Chicago, assignor to Safety Mining Co., Chicago. Oct. 13, 1931.

Blasting Cartridge; 1,827,318. Frank H. Kneeland, Chicago, assignor to Safety Mining Co., Chicago. Oct. 13, 1931.

Cable Reel for Mining Machines; 1,827,-380. Howie Boggs, Pound, Va. Oct. 13, 1931.

Drop-Bottom Mine Car; 1,827,399. Herman H. Pancake, Huntington, W. Va., assignor to American Car & Foundry Co., New York City. Oct. 13, 1931.

Apparatus for Coking Coal; 1,827,484. Samuel W. Parr and Thomas E. Layng, Urbana, Ill., assignors to Urbana Coke Corporation, Urbana, Ill. Oct. 13, 1931.

Classification Apparatus; 1,827,894. Alexander D. Marriott, Denver, Colo., assignor to the Dorr Co., Inc., New York City. Oct. 20, 1931.

Distillation of Coal; 1,827,896. Edward S. Mead, Philadelphia, Pa., assignor of one-half to J. P. Edwards, Philadelphia, Pa. Oct. 20, 1931.

Mine Car; 1,828,263. Noel D. Veth, Barnesville, Ohio, assignor to Watt Car & Wheel Co., Barnesville, Ohio. Oct. 20, 1931.

Mine Car; 1,828,266. Charles W. Watt, Barnesville, Ohio, assignor to Watt Car & Wheel Co., Barnesville, Ohio. Oct. 20. 1931.

Apparatus for Making Briquets; 1,828,-586. Hugh Archbald, Philipsburg, Pa. Oct. 20, 1931.

Coal Washing Apparatus; 1,828,760. Francis H. Blatch, Hazleton, Pa. Oct. 27, 1931.

Auxiliary Unit for Mining Machines; 1,829,549. Benjamin W. Snodgrass, Denver, Colo. Oct. 27, 1931.

Safety Device for Mine Buckets; 1,829,-587. Thomas Fisher, Carl Junction, Mo., assignor of one-third to J. H. Bennett, Carl Junction, Mo.

Blasting Cartridge; 1,829,855. Raymond W. Dull, La Grange, Ill., assignor to Safety Mining Co., Chicago. Nov. 3, 1931.

Picking Screen; 1,830,070. R. G. Miller, Huntington, W. Va., assignor to Roberts & Schaefer Co., Chicago. Nov. 3, 1931.

Coal Breaker; 1,831,683. George Norton, Birmingham, England. Nov. 10, 1931.

Electric Mine Firing Device; 1,832,052. N. Schmitt and O. Schmitt, Kuppersteg, Germany. Nov. 17, 1931.

Mine Car; 1,832,754. Noel D. Veth, Barnesville, Ohio, assignor to Watt Car & Wheel Co., Barnesville, Ohio. Nov. 17, 1931.

Cartridge Charging Device; 1,832,639. Frank H. Kneeland, Chicago. Nov. 17, 1931.

Publications Received

Mechanism of Combustion of Individual Particles of Solid Fuels, by David F. Smith and Austin Gudmundsen. Mining and metallurgical investigations under auspices of U. S. Bureau of Mines, Carnegie Institute of Technology, and Mining and Metallurgical Advisory Boards. Cooperative Bulletin 49; 21 pp., illustrated. Price, 25c. Mining and Metallurgical Advisory Boards, Pittsburgh, Pa.

Mineral Resources of the United States, 1930 (Summary). U. S. Department of Commerce, Washington, D. C. Pp. 120. Price, 20c.

Permissible Coal-Handling Equipment Approved From January, 1926, to December, 1930, inclusive; by L. C. Ilsley, E. J. Gleim, and H. B. Brunot.

Accidents From Hand and Mechanical Loading in Some Illinois Coal Mines, by A. C. Callen and C. M. Smith. (Report prepared under a cooperative agreement between the Engineering Experiment Station of University of Illinois and Illinois State Geological Survey.) Bulletin No. 231; 46 pp., illustrated. Price, 25c. University of Illinois, Urbana, Ill.

Jigging, Classification, Tabling, and Flotation Tests of Coals Presenting Difficult Washing Problems, With Particular Reference to Coals From Pierce County, Washington, by B. M. Bird and S. M. Marshall. Covers one phase of an investigation by the Pacific Coke & Coal Co. in cooperation with the U. S. Bureau of Mines and the University of Washington to determine whether coals from an undeveloped area of Pierce County, Washington, can be used in the manufacture of coke for the iron blast furnace. Bulletin 337; 132 pp., illustrated. Price, 35c. Bureau of Mines, Washington, D. C.

An Economic Study of the Use of Hocking Valley Coal With Underfeed Stoker Equipment, by H. M. Faust. Bulletin 63; 57 pp., illustrated. Price, 50c. Covers a series of boiler tests made with coal from the Ohio No. 6 seam in the Hocking Valley district. Engineering Experiment Station, Ohio State University, Columbus, Ohio.

Trade Literature

Air Compressors. Ingersoll-Rand Co., New York City, in a 52-pp. illustrated bulletin entitled "Equipment for the Coal Mine," describes its various types of mine-car compressors, snubbers, drills, concrete breakers, hoists, etc.

Coal Washer. McNally-Pittsburg Mfg. Corporation, Pittsburg, Kan., has issued a 12-pp. illustrated bulletin entitled "Coal Cleaning by Norton Automatic System," describing the operation of this system.

Screens. Manganese Steel Forge Co., Philadelphia, Pa. Bulletin 230; 16 pp., illustrated. Gives detailed information regarding methods of application of Rol-man screens to various types of revolving equipment, in addition to describing its advantages.

Timber Treatment. Ayer & Lord Tie Co., Chicago, has issued a 16-pp. illustrated booklet entitled "Termites — A Growing Menace to Untreated Timber." Covers the method of attack of these white ants and prevention of the damage done by them.

Electrical Equipment. Single-phase repulsion-start-induction motors and single-phase split-phase motors are illustrated and described in Bulletin 167, 30 pp., issued by Wagner Electric Co., St. Louis, Mo.

Electrical Equipment. General Electric Co., Schenectady, N. Y. Catalog GEA-606C; 196 pp., illustrated. In addition to information on Industrial Control, the care and operation of control devices, wiring diagrams of standard controllers, pushbuttons, and other accessories are covered.

Screens. Robins Conveying Belt Co., Chicago. Bulletin No. 80; 19 pp., illustrated. In addition to describing the four elements of the Style C Gyrex Screen—the live frame, vibrator, springs and base—information on capacity, strokes, speeds, horsepower, etc., is included.

Apron Feeders. Link-Belt Co., Chicago, has issued Book No. 1,351, on its Heavy Duty Apron Feeders. Tables and drawings for the proper width of the apron, pitch of chain, sprocket sizes, size of head shaft, are included.

Speed Reducers. General Electric Co., Schenectady, N. Y. GEA-1437, leaflet illustrating and describing built-in speed reducers for general-purpose induction motors.

Turbine-Generator Sets. General Electric Co., Schenectady, N. Y. GEA-1,335; folder illustrating and describing 10- to 300-kw. alternating-current turbine-generator sets.

Speed Reducers. W. A. Jones Foundry & Machine Co., Chicago. Bulletin 53, 7 pp., illustrated. Covers information on double reduction Herringbone-Maag speed reducers for small motor drives.

Electrical Equipment. General Electric Co., Schenectady, N. Y. — Single-phase Vertical Motors, Type SCR, GEA-1475; Medium-speed Alternating-current Generators, for belt drive or direct connection, GEA-1483. These are illustrated folders.

Fan. Jeffrey Mfg. Co., Columbus, Ohio, has issued an illustrated folder describing the new Aerovane mine fan.

Chains. Roller chain drives are illustrated and described in Bulletin R 50, 16 pp. Dimensions and prices are included.

Electrical Equipment. L. 20,520, issued by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., covers operation, construction and ratings of Westinghouse-Wise multi-speed drive; illustrated.

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Report Forms for Classifying Mine Accidents

As an aid to the determination of results from the use of protective hats, goggles and safety shoes, and to provide information in such form that it can be used currently in the drive to eliminate accidents, the Valier Coal Co., southern Illinois, classifies all reported accidents. These classified records are kept on form sheets hanging in the superintendent's office.

Check No	Name	No Times Injured	Safety Equip
		THL	⊠
			O
			X
			□

Legend □ Safety shoes X Protective hat O Goggles

Fig. 1—Individual Man Injury Record

Two forms are used for the purpose. One is an individual man injury record, reproduced in Fig. 1. It shows whether at the incidence of an accident the victim was equipped with or wearing the gear which would have prevented or mitigated hurt, and covers all except company men. In the right-hand column and opposite each man's check number and name is indicated whether he wears safety shoes, a protective hat and goggles. No matter how slight a reported injury, it is tallied against his name. In this way a permanent record is set up for the guidance of the foremen in watching the careless and trusting the safe workers.

Fig. 2—Weekly Injury Classification Report

Injury	Week of Jan 1-7	Jan 7-14
Eye		
Head		
Body		
Foot		
Total		

Legend ① ② ③ ④ ⑤ ⑥

As an added stimulus to the elimination of safeguardable injuries, a weekly injury classification report is kept in the form shown in Fig. 2. Each main classification of accidents is subdivided as to whether caused by coal or by a mechanical agency. Injuries are posted according to their nature by a series of encircled numerals, each of which stands for some specific injury in a legend familiar to the officials.

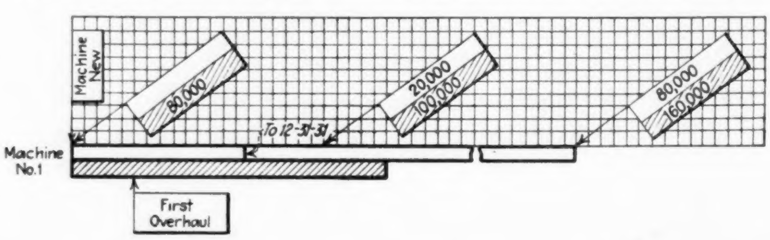
Graphic Records Point Out Hidden Facts

At one of the completely mechanized mines extensive use is made of the graphic method of keeping records. But this practice is not followed to the exclusion of ledger records, which are recognized as indispensable to intelligent management. Rather, one method is used as the key to the other. In the ledger figures are hidden much information and many facts which only a graphic presentation will bring into prominent view. Furthermore, it has been found that only by graphs and charts can trends be shown in such manner as to be immediately discernible to the eye. When a factor or phase of operation falls out of line, the graphs will, of course, indicate the discrepancy, but they will not give the details. These must be searched out in the ledger records.

As the company operates a large number of loading machines, some ready reference was needed to tell how each individual machine was performing and to make comparisons between the several so as to maintain a standard. A day-to-day study of machine performance is made through the medium of a simple bar chart. The daily tonnage is plotted on a large sheet, which is ruled with horizontal lines to represent tonnage and with vertical lines that divide the year into days and months, results for each machine being plotted separately, one under the other.

But that chart does not tell the story of machine performance over a long period of time. This information is presented by the production progress chart illustrated in Fig. 1. In its complete form the graphic record provides a chart for each machine, one under the other, and at the bottom is a master chart giving a summation of progress of all machines. Tonnage is recorded horizontally in increments of 10,000 tons (20,000 in the illustration). The top bar (colored red) goes from 0 to 80,000 tons and the bottom bar (yellow), taking up the measurement where the top bar leaves off, goes from 80,000 to 160,000. This arrangement is followed in order that the chart shall cover at least two years of operation and at the same time allow the use of a large scale. The only difference between the individual machine charts and the master chart is that the latter has a unit of

Fig. 1—Production Is Lagging; Does the Machine Need an Overhauling?



measure whose value is ten times that of the former.

With this chart before them, the officials can tell how much coal any or all of the machines loaded in any given period. Of even greater value is the guidance this chart gives to maintenance. When a machine is overhauled, that fact is indicated on the chart with respect to the tonnage it produced before being overhauled. This indicator is held important as tons of production rather than time determines the need for overhauling. With this scheme in operation, if the production of a machine shows a continuing drop, the reason, if it be that the machine needs overhauling, will come to immediate notice.

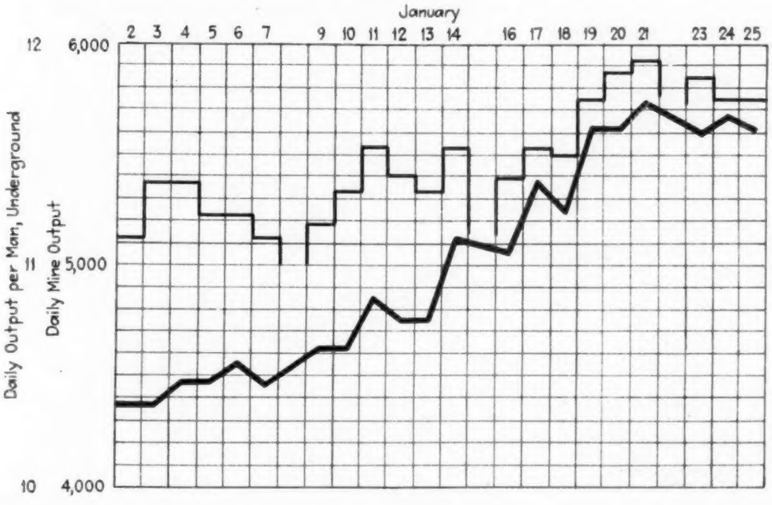
What is the relationship between daily plant output and daily output per man underground? That information is useful as an index of the efficiency of labor in a mechanized operation. But as pertaining to one shift only, that information has little value. A trend must be established, and this can be done only through the use of a graph. How the trend is determined at the operation under consideration is illustrated in Fig. 2, a chart which covers a period following a shutdown. As or if daily plant output climbs, the output per man underground should change, not necessarily in the same degree but certainly in the same direction, normally.

The key to the hiding place of many operating facts will be given to an inquiring mind by this simple graph. With the daily plant output running uniformly at a fixed level, why should there be any wide fluctuation in the per man output, or why a distinct decline? The plant manager would ask that question and many others dealing with daily, weekly, monthly and even yearly periods. During the month of March the per man output was 11.2 tons; this month, with the same plant output, the per man output has declined to 10.0 tons. Why? Perhaps too many men somewhere; a new construction job; too much or not enough development work; working places becoming more scattered; a shift of activity to a newly developed section—one or more of these and many other factors will be brought to light through the inquiry set into motion by discovery of the one basic fact.

Stumped

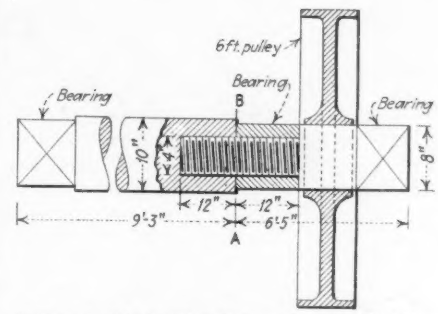
For an engineer, mechanic, or electrician to say to his boss, "I'm stumped" should not always be a reflection on the man. But, unfortunately, such almost invariably is the case. There are times in every man's workaday life when he must bow in defeat. Those occasions, however, can be minimized—in coal mining work by closely following the operating ideas published regularly in *Coal Age*. You are a reader of these pages, but are you also a contributor? Aside from the good that comes from writing up your ideas, you will be paid for them on acceptance at the rate of $5 or more each. Kindly use an appropriate sketch or photograph to illustrate your idea.

Fig. 2—Why the Drops in Daily Per-Man Output? The Daily Plant Output Is Up



How Broken Fan Shaft Was Fixed Within 24 Hours

If a fan shaft should break, what steps would be taken to meet the emergency? Certain it is that the repair or replacement job should be performed without waste of time; first, because of the underground dangers involved and, second, for the obvious reason that the plant cannot operate until ventilation is restored.



A Repair Made Ten Years Ago Is Holding to This Day

This problem was encountered at one of the mines of the Davis Coal & Coke Co., at Thomas, W. Va., in February of 1921, during a period of heavy thawing and freezing which threw the bearings of the fan shaft out of line and caused a break to occur. The point of break is shown by *AB* in the accompanying sketch. Within 24 hours the break was repaired and the fan back in service. Details of the job are furnished by W. C. Tillson, of Cassity, W. Va.

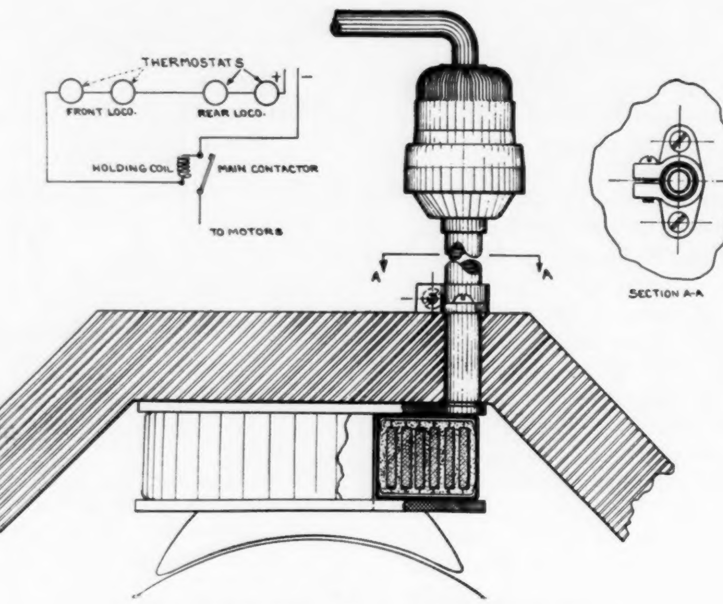
The shaft was dismantled and taken to the shop where the ends were faced square in a lathe. Holes 4 in. in diameter were then bored in the two ends to a depth of 12 in. and threaded, three threads to the inch. These threads were made right-hand for the reason that the shaft ran clockwise. A close-fitting stud was then turned and the two ends brought together in a tight screw fit. It was found that the shaft ran true after the repair was made and has given no trouble since.

Thermal Control Relays Cut Locomotive Maintenance

Armature and field coil troubles are held responsible for a large portion of the time spent by mine locomotives in the repair shop. For the elimination of this costly item of maintenance a new type of locomotive motor thermal protection is used at the mines of a large coal company operating in West Virginia and Kentucky.

The relay consists of a sylphon element operating a control switch, inclosed in a Bakelite case—both of which are hermetically sealed. It is installed by drilling a ½-in. hole through the motor frame and shield of one of the field coils. The bottom of the tube housing the thermal element makes direct contact with the insulation of one of the coils. While the control switch member is both moisture- and dust-proof, the top half may be unscrewed so as to make easily accessible the wiring connections necessary for the control circuit.

The control circuit maintains and interrupts the operating coil of the main



Installation Details of Motor Thermal Protection

contactor, furnishing current to the motors. The coal company employs a positive circuit through the relays, so that in the event of a grounding of any part on the control circuit, the locomotive becomes inoperative, quite the same as if one of the relays itself had operated. This prevents the control circuit being placed out of service without the knowledge of the operator.

The relays, which were developed by the Automatic Reclosing Circuit Breaker Co., are supplied to trip at a temperature of 90 deg. C., which is about 10 deg. under rated temperature for the armature. Other operating temperatures than this, however, can be had if desired. This type of protection is considered much more desirable than the use of current overload relays to prevent overheating from overloading, as lost time due to the locomotive being out of service is considerably less. The locomotive is not penalized except during such periods as the temperature of the coils becomes excessive, and maximum safe loads can be carried as long as necessary every shift. The relay is automatically reset when the coil temperature drops to 68 deg. C., when the circuit is reestablished to the operating coil of the main contactor.

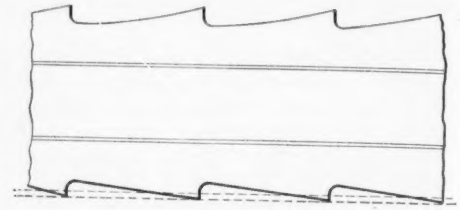
The accompanying sketch illustrates the method of installing the relays and also shows the arrangement of the control circuit. Either a single relay or two relays on each front and rear motor may be used, although in most installations it has been found that the single relay for the front motor and another for the rear motor will furnish ample protection against premature field coil and armature breakdowns. The coal company has been using thermal controls for more than 30 months and during that time not a single field coil or armature has been damaged due to overloads on a locomotive so equipped.

Shearing Straightens Rib

Experience has shown that with the shortwall cutting machine it is practically impossible to maintain a straight rib for any great distance. The usual outcome is an irregular saw-toothed rib line which, with respect to the track, leaves more than enough clearance at some points and far from enough at others. Projecting points can, of course, be worked off by hand pick, but this method is slow and expensive.

At a mine in eastern Ohio a slabbing shear cut was taken to eradicate inequalities on the clearance side, using a track-mounted combination horizontal cutting and shearing machine. The real reason for providing greater clearance was the installation of a wider car.

The cutter bar was placed in shearing position, extended as far to the side as required to give the desired clearance,



Rib Line Before and After

and the rib literally slabbed. In places only a few inches were taken, in others several feet, and in still others none at all. In this way nearly 8,000 lin.ft. of entry was widened out, and at a small fraction of the cost by hand methods.

Remote-Control Switch Device Makes for Safer Haulage

A switch control mechanism designed to avoid the necessity of motormen on the main haulage roads having to leave their motors and run ahead to throw switches lined against them, and of couplers jumping from moving trips of empties to throw entry switches, has been devised by mine mechanics at the Kayu mine of the Koppers Coal Co., Coxton, Ky., under the supervision of C. R. Jones, mine foreman.

The device, described by D. D. Jenkins, is a simple application of the toggle joint. Actuated by the throw of a switch lever, a rod which connects the switch lever and the toggle operates the bridle bar of the switch through the toggle joint. Tension exerted upon it, and thus upon the switch points by the spiral spring shown in the sketch, assures close fitting of the points and positive action of the mechanism. Parts needed for the construction of the apparatus are made from flat or round iron-bar stock, except the throw-stand base, which is cut from sheet iron.

At the Kayu mine throw-stands are

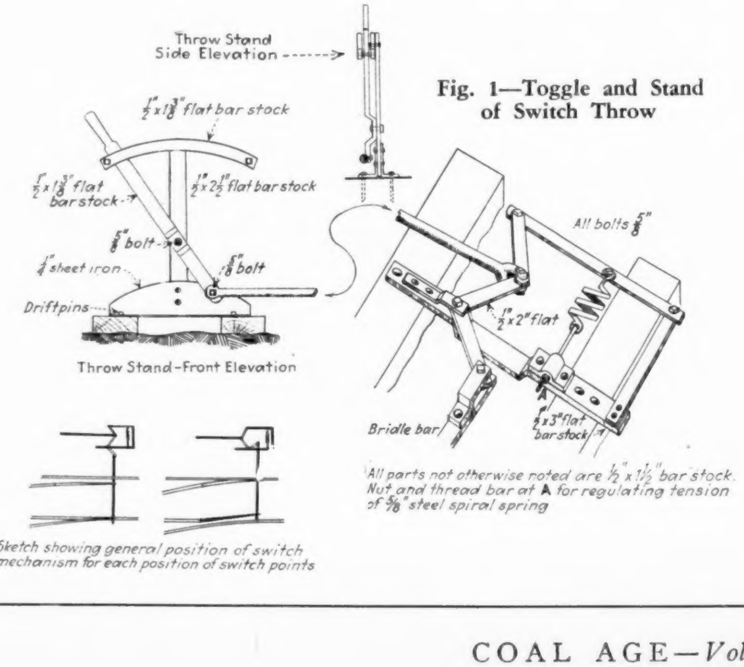


Fig. 1—Toggle and Stand of Switch Throw

Sketch showing general position of switch mechanism for each position of switch points

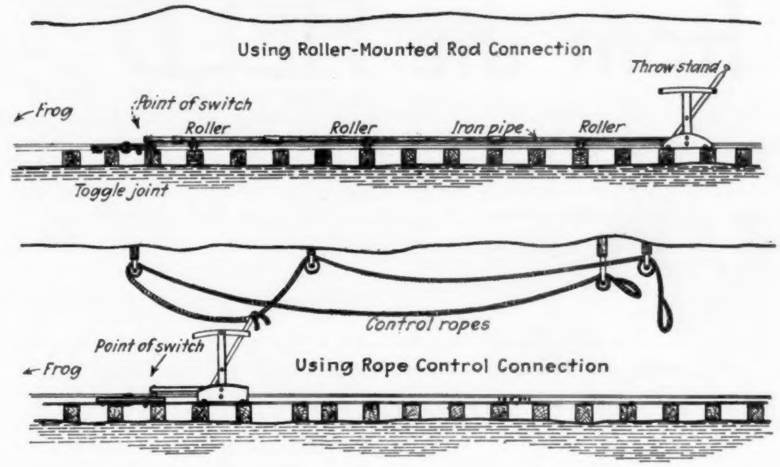


Fig. 2—Two Methods of Throwing the Switch by Remote Control

installed from 25 to 50 ft. from the switch, the rod connection between them running over rollers made from worn trolley wheels mounted on chairs of strap iron spiked to ties at 10 or 12-ft. intervals.

In one or two installations, however, the throw-stands are set up at the switch and operated by ropes running over pulleys fastened to plugs driven into the top. The details of this arrangement are shown in Fig. 2.

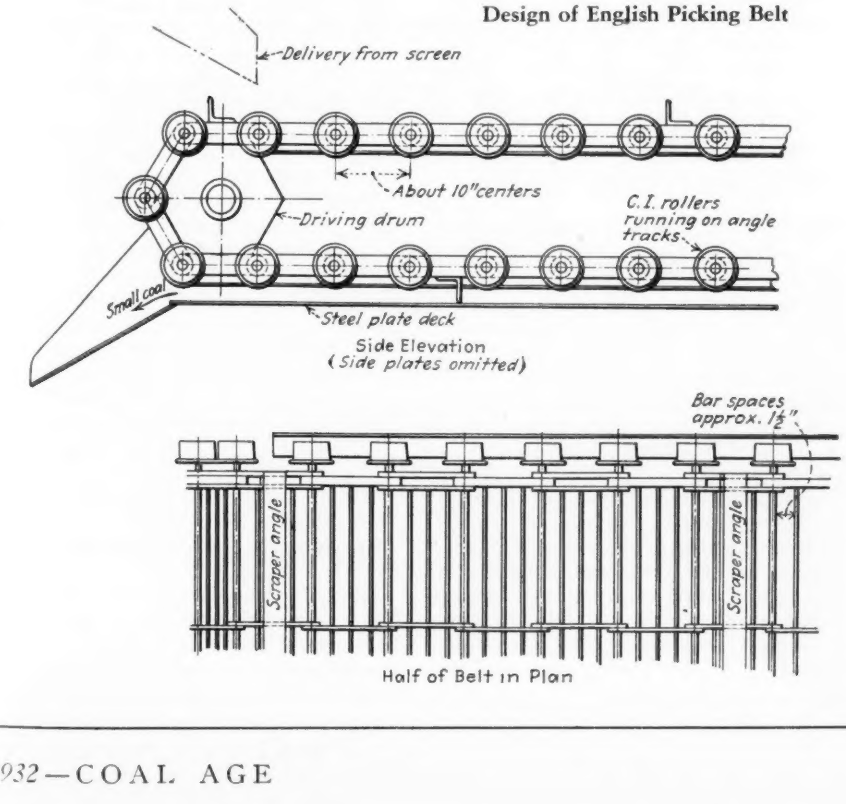
When properly installed and lubricated, the switch lever can be tripped almost with a finger. This allows the motorman or coupler to operate the switch ahead of him by merely leaning out and tripping the lever as he goes by, practically eliminating the chance of accident, which is appreciable when the standard switch throw mechanism is used, unless trips are stopped or slowed down considerably.

Picking Belts Screen Out Smalls In British Plants

Screening practices in England, including picking tables or belts, differ in many respects from those generally followed in the United States. An example of one of these differences is the design of the picking belt in use at the Bilsthorpe colliery of the Stanton Ironworks Co., Ltd., near Mansfield, England, as described by N. D. Todd, colliery general manager.

The bar picking belt used at this plant has wide acceptance in Great Britain. Its merit lies in the quick and continual removal of undersize throughout the path of travel of the coal on the belt. The small coal falls on a steel plate deck under the return side of the belt, where it is scraped back by angles on the belt itself (see sketch) to the receiving end, and there discharged down a chute for disposal. At Bilsthorpe the discharge is made to a belt which takes small coal to the washery.

Design of English Picking Belt

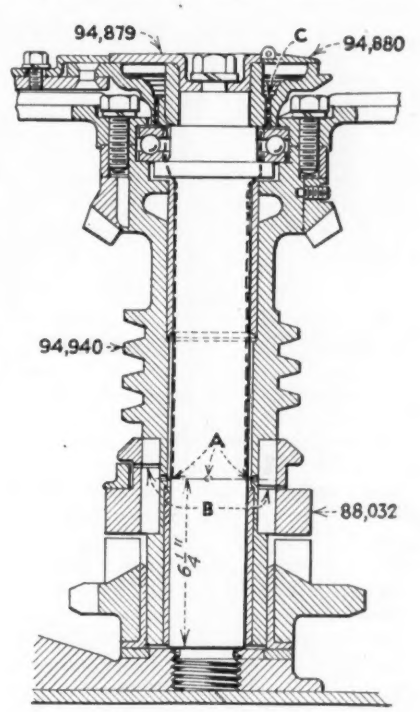


Changes in Bit Clutch Oiler

Actual cutting time per mining machine has been increased at least one hour per shift, better lubrication is afforded, and oil per machine per shift is being saved at Nellis mine of the American Rolling Mill Co. by a change in the method of lubricating the bit clutch, according to T. W. Blake, chief electrician. The changes outlined refer to types 35 B and 35BB shortwall machines. Five machines with the revised oiling system are working at Nellis.

By drilling certain holes to allow a flow of oil it becomes possible to oil the machine without stopping it and without removing the cover. Part No. 92985, oil cup and pipe, is no longer used. Oil holes are not exposed to, and therefore not clogged by, cuttings carried around by the cutter chain.

Referring to the drawing, it is necessary to drill ½-in. holes (*A*) through part No. 94940, all 6¼ in. from the bottom and each 1 in. offside of the clutch slide keyway. Next drill two ½-in. holes (*B*) in part No. 88032, one into the top of the groove and the other into the bottom



Showing New Oil Holes

of the groove. Also drill one ½-in. hole (*C*) in part No. 94879, thus providing it with two holes instead of one.

Oil is poured in through the opening which is protected by lid No. 94880. As the oil flows downward it lubricates successively the ball thrust bearing and the upper bushing on the vertical shaft. At the top of the bottom bushing, part of the oil goes out through the holes and lubricates the bit clutch. The remainder works down along the bottom bushing and out to the wearing ring of the bottom bearing. Any excess of lubricant finds its way onto the cutter chain.

WORD from the FIELD

Rocky Mountain Institute To Meet in June

Safety, cost-cutting methods of mining coal, and economic questions facing the industry will be discussed at the 1932 meeting of the Rocky Mountain Coal Mining Institute, to be held at Salt Lake City, Utah, June 8-10. One technical session will be held on June 8, and will be devoted to safety, accident prevention, economies, proper accident records, and safety appliances as a means of cutting the cost of mine accidents. The session will be featured by the presentation of Joseph A. Holmes safety awards to Rocky Mountain mines and individuals.

Shaking conveyors, electric haulage, and economies in the use of power are the topics scheduled for the morning session on June 9. Final technical sessions will be held on June 10, with the following topics scheduled for discussion: the future of coal, extension of the market for Rocky Mountain coal, the regional sales plan, and stokers as a means of increasing the use of coal.

New Plant Construction

New contracts for topworks and construction under way or completed at various coal operations in April were as follows:

Blackwood Coal & Coke Co., Blackwood, Va.; contract closed with the Fairmont Mining Machinery Co. for crushing equipment, consisting of crusher, gravity screens, and conveyors; capacity, 300 tons per hour.

Continental Coal Co., Brock Mine, Cassville, Va., contract closed with the Fairmont Mining Machinery Co. for pea-coal screening plant, including vibrating screens, conveyors, and steel structure; capacity, 300 tons per hour.

Heisley Coal Co., Nanty-Glo, Pa.; contract closed with the Fairmont Mining Machinery Co. for pea-coal screening, including vibrating screens and auxiliary equipment; capacity, 100 tons per hour.

Norfolk & Western Ry., fuel department, Pond Creek Mine, Williamson, W. Va.; contract closed with the Kanawha Mfg. Co. for steel-structure crushing and cleaning plant, including dump hopper, feeder, and rope-and-button conveyor from Thacker seam, and trip feeder, rotary dump, apron feeder, shaker screens, two picking tables, and two crushers with bins and chutes from

the Pond Creek seam. Coal will be screened to lump, egg, and slack for cleaning, and the lump and egg may be crushed before being loaded with the slack, or may be combined with the slack to make a cleaned mine-run. Capacity is 300 tons per hour, or 150 tons from each seam.

Wide Range of Topics Scheduled For Retailers' Meeting

The entire range of problems facing the retail coal dealer, including oil and gas competition and trucking, will be discussed by speakers at the 15th annual convention of the National Retail Coal Merchants' Association, to be held at Louisville, Ky., May 19-21, by representatives of the anthracite and bituminous industries, the dealers, the railroads, and manufacturers of coal-burning equipment. The speakers include Gen. Brice P. Disque, executive director, Anthracite Institute; H. A. Glover, chairman, Committee of Ten—Coal and Heating Industries; C. B. Huntress, executive secretary, National Coal Association; W. R. Cole, president, and E. S. Jouett, first vice-president, Louisville & Nashville R.R.

Haddock to Build Breaker

Haddock Mining Co., Wilkes-Barre, Pa., has let a contract for the construction of a new breaker at the Salem Hill Colliery, Pottsville, Pa., to the McCarter Iron Works, Norristown, Pa. The new plant will have a capacity of 500 tons per day, and cleaning will be done in a Chance cone. Future trends in anthracite sizing were considered in the design of the breaker. No provision is made for egg, which the management regards as commercially dead. Foreseeing the eventual obsolescence of the other larger sizes, roll design and other breaker details have been modified so that their production can be discontinued in the future. Paul Sterling, mechanical engineer, Lehigh Valley Coal Co., Wilkes-Barre, designed the plant.

Miners' Future Considered

A long-time program for the rehabilitation of the coal miner, his adaptation to other types of work, or his assimilation into other industries, such as farming, road building, and general mechanical pursuits, was the subject of a conference between representatives of the bituminous coal industry and the American Friends' Service, held April 15 under the auspices of the President's Organization on Unemployment Relief. Coal men attending the conference were: W. J. Clothier, president, Boone County Coal Corporation; T. B. Davis, president, Island Creek Coal Co.; Brooks Fleming, Jr., assistant to the president, and Fred A. Krafft, director of industrial relations, Consolidation Coal Co.; Thomas E. Lightfoot, safety director, Koppers Coal Co.; L. E. Young, vice-president, Pittsburgh Coal Co.; D. C. Kennedy, executive secretary, Kanawha Coal Operators' Association; W. E. E. Koepler, secretary, Pocahontas Operators' Association; and C. B. Huntress, secretary, National Coal Association.

C. F. & I. Anniversary

The fiftieth anniversary of the rolling of the first steel rail at the then Bessemer works of the Colorado Coal & Iron Co., Pueblo, Colo., was celebrated by the Colorado Fuel & Iron Co., on April 12. This event, according to the anniversary edition of *The C. F. & I. Blast,* was antedated by 10 years of development and organization work, which started with the incorporation of the Central Colorado Improvement Co. on Jan. 11, 1872, four years before Colorado became a state. On Dec. 13, 1879, the improvement company, together with the Southern Colorado Coal & Town Co. and the Colorado Coal & Steel Works Co., was merged into the Colorado Coal & Iron Co. In October, 1892, the Colorado Coal & Iron Co. and the Colorado Fuel & Iron Co. were consolidated into the present organization.

Engineering Firm Opens Office

Stuart, James & Cooke, Inc., New York City, has opened an office in the Scranton Electric Building, Scranton, Pa., to handle engineering and management problems in the anthracite region.

Coal Operators Open Fight on Davis-Kelly Bill at Washington Hearings

IN AN impressive show of strength, coal operators of the country marshaled their forces against the Davis-Kelly and Lewis coal bills last month, when hearings were resumed on April 18 by the Senate Subcommittee on Mines and Mining. Representative David J. Lewis, Maryland, the first witness, explained his coal control bill (*Coal Age*, March, 1931, p. 123) at the initial hearing, after which representatives of the National Coal Association, state and local operators' associations, and business organizations throughout the country filed notices for the appearance of opposition witnesses at future sessions.

Both the Davis-Kelly and Lewis bills were attacked as unconstitutional by Judge H. D. Rummel, counsel for the National Coal Association and the West Virginia Coal Association, who declared that coal mining is not interstate commerce and that any attempt to regulate it as such would be ineffectual. All Congress can regulate is the transportation of coal between states and, he asserted, the Davis-Kelly bill contains not one word pertaining to transportation. Analysis of the statements of Representative Kelly, according to Judge Rummel, shows that he proceeds upon the theory that he is attempting to correct overproduction and excessive, destructive competition, neither of which constitutes interstate commerce, and therefore are conditions subject only to state control.

The contention that Congress has greater power to regulate corporations in interstate commerce than individuals, said Judge Rummel, is untenable and contrary to the decisions of the Supreme Court. Congress can only regulate, he contended, and has no power to exclude coal from interstate commerce, or enforce arbitrary regulations by which it can enter.

The broad powers to be given to the proposed commission, he asserted, are contrary to the public interest. Such a commission cannot make its own regulations, as is proposed by the sponsors of the Davis-Kelly bill, but must administer the regulations laid down by Congress. The remedy for present conditions within the industry is contained in the sales agency plan, as epitomized in Appalachian Coals, Inc., which he felt would be declared legal by the Supreme Court.

While the plan for establishing cooperative marketing agencies contained in the bill is not objectionable, the price of this relief makes it doubtful if operators will ever voluntarily accept it, declared Charles O'Neill, vice-president, Peale, Peacock & Kerr, Inc., and chairman, government relations committee, National Coal Association, on April 28. Since the War, Mr. O'Neill pointed out, the bituminous industry has been faced with the problem of adjusting over-capacity brought on by war-time demands, transportation difficulties, and strikes to a demand which has been cut down by combustion economies and the competition of foreign and domestic oil, natural gas, and waterpower. This has intensified competition in the industry and caused liquidation of wage scales.

Present distress among the miners is primarily due to the short running time imposed on the industry in 1930 and 1931. However, this condition is not peculiar to mining alone, and the labor situation in soft coal will right itself with the return to normal conditions, "especially if the industry is permitted to eliminate wasteful methods of operating and selling through the establishment of cooperative selling agencies, and is left free from costly and restrictive control of a bureaucratic commission in Washington.

"It is idle to talk of increasing the total income of the industry for miners and operators during a period of market contraction which is synonymous with declining prices." Present income can be enhanced only by a resumption of the upward trend of consumption. When wage rates have reached their lowest levels, a reduction in the destination price is dependent upon the other elements that enter into the delivered price. Railroad rates should be reduced to bring destination price down sufficiently to allow coal to compete with other fuels which are taking away its markets. Freight rates are too high by 50c. to $1 per ton, he asserted, and should be cut to enable coal to recover some of its lost business.

Practical objections of the industry to the Davis-Kelly bill were listed by Mr. O'Neill as follows:

1. The bill subjects only one private industry to government control of labor relations and operating and selling methods.

2. Cost of operation would be increased, resulting in an increase in destination price and further contraction of coal, thereby benefiting competitive sources of power.

3. The bill is designed to unionize an industry that was never completely union and is today preponderantly nonunion because of the inability of miners and operators to reach agreements as to the methods of negotiating proper wage levels. Legal status is not given to agreements between employers and employees, and such legal responsibility as is fixed for carrying out such agreements implies that employees will be free to break agreements at will, whereas employers are bound by their licenses to abide by the agreements.

4. Four classes of mine operators are set up by the bill. One class is free of labor regulations, while a different set of regulations applies to each of the other three classes, leaving open the door to demoralized conditions if all four classes were operating in a single field.

5. The bill is vague and indefinite in that it does not clearly state what it intends to do: namely, take over the control of coal mining from the states; provides for the appointment of five commissioners without stating what their qualifications should be; and is unfair in that corporations desiring to ship in interstate commerce or enter into cooperative selling arrangements must sign a pledge in advance to observe commission rules and regulations, thus giving the commission a blank check.

6. There is no limitation in the bill on the authority of the commission to require information and reports, except that the information must be necessary to help the commission carry out the purposes of the act.

7. The power of the commission extends to the almost insurmountable obstacle of fixing prices, which, considering the varying conditions of production, should be the result of free flow of supply and demand or by gigantic mergers.

8. The burden of increased costs would fall on the public in the form of higher prices, which would be contrary to the public interest.

9. Regulations on the granting of permits for railroad connections or sidings are widely at variance with former conceptions of the shippers' rights.

10. While the bill offers inducements in the form of permission to participate in joint selling organizations, a number of handicaps make operator acceptance unlikely. These handicaps result from the unlimited power given the commission to specify the conditions under which a company could operate, thus depriving management of its own business and the determination of its own labor relations.

"Governmental regulation is under a severe test in the matter of railroads today," Mr. O'Neill concluded. "It might be well to see how it works under keen competition and distressing economic conditions. If regulation cannot restore prosperity to the rail transportation companies with all of the experience that the carriers and [Interstate Commerce] Commission have had during the past 45 years, I cannot conceive of a newly formed and inexperienced commission doing anything in

Permissible Plates Issued

Two approvals of permissible equipment were issued by the U. S. Bureau of Mines in March, as follows:

(1) Gellatly & Co.; Type W conveyor; 15-hp. motor, 250-500 volts, d.c.; approvals 240 and 240A; March 12.

(2) Sullivan Machinery Co.; Type CR-2 shortwall mining machine (with remote control); 50-hp. motor, 250-500 volts, d.c.; approvals 241 and 241A; March 18.

this direction with a private industry embracing thousands of separate units working under much greater variable conditions than railroads. The task for the coal commission would be much more difficult."

An array of legal decisions were cited on April 29 by A. M. Liveright, Clearfield, Pa., counsel for the Central Pennsylvania Coal Producers' Association, to show the following: coal mining is not interstate commerce and therefore is not subject to control by Congress; also, coal mining is not affected with a public interest, and regulatory legislation would be unconstitutional; oil and gas are not subject to federal control to prevent waste and, by analogy, neither is bituminous coal; the clause of the bill providing that a licensee becoming a member of a selling association shall not make membership in a labor association a reason for refusing employment is unconstitutional in that it attempts to control contracts between employers and employees; Congress cannot delegate its regulatory powers to any commission, such as is proposed in the bill.

A summary of the testimony that succeeding operator witnesses would present brought John L. Lewis, president, United Mine Workers, to the floor on April 30. Mr. Lewis charged that the operators were deliberately trying to prolong the hearings and thus prevent Congressional action on the bill, and requested an early end to the testimony.

Losses to oil and natural gas in the Southwest were cited by Grant Stauffer, Sinclair Coal Co., Kansas City, Mo., in testimony on May 2. Regulation, in Mr. Stauffer's opinion, would not aid consumption. Zoning of coal markets, a possibility under the terms of the bill, would cause present consumers to discontinue buying from the usual sources, and "would amount to confiscation of the property of many coal operators and many factories." Already "many communities contiguous to large mines have been destroyed due to competitive fuels." Under government control, prices of manufactured articles would have to be increased to cover the higher cost of fuel, if that fuel were coal.

F. O. Sandstrom, secretary, Colorado & New Mexico Coal Operators' Association, Denver, Colo., detailed the effects of natural gas and fuel oil competition in the Rocky Mountain region, and pointed out that anthracite and lignite would not be regulated, thus opening the door to the displacement of bituminous coal. Mr. Sandstrom asserted that the Davis-Kelly bill failed to make clear the ultimate purposes of such regulation and the rules of conduct, and contended that joint selling organizations should be permitted by amendment of the antitrust laws if conditions warrant them. The Davis-Kelly bill does not accomplish that result. Another fundamental defect in the bill, he declared, is the lack of some means of requiring consumers to pay the increased prices which regulation would entail. Further, the bill would deny applicants for licenses equal protection of law, as the commission's powers would be arbitrary in the absence of any rule for granting or denying licenses.

Declaring his substantial agreement with the previous statement of Charles O'Neill, B. M. Clark, Indiana, Pa., president, Rochester & Pittsburgh Coal Co., Helvetia Coal Mining Co., and the Kent Coal Mining Co., at the May 3 hearing, opposed government control of any private business, stating that no commission of five members or 100 miners could run the coal industry without working great injury to invested capital and employees. The section of the Davis-Kelly bill requiring licensing of producers shipping in interstate commerce within 60 days after passage of the act was termed unfair, unreasonable, impractical and unworkable, because such a provision would disrupt contractual obligations.

Machine-Loaded Tonnage Up

Despite the depression, production of bituminous coal by "mechanized mining" underground rose 1.3 per cent from 46,982,000 tons in 1930, or 10 per cent of the annual output, to 47,584,000 tons in 1931, or 12.5 per cent of the year's production, according to figures compiled by the U. S. Bureau of Mines. Tonnage loaded by hand dropped 21.5 per cent. The number of mobile loaders, scrapers, and duckbills increased from 835 to 887, while the number of pit-car loaders rose from 2,876 to 3,411. Of the 1931 tonnage handled by machines, mobile loaders accounted for 40.8 per cent; scrapers, 3.1 per cent; pit-cars 56.1 per cent.

The total coal handled by self-loading conveyors rose from 1,628,000 tons in 1930 to 1,798,000 tons in 1931, or 10.4 per cent. Pit-car loaders and other hand-loaded conveyors accounted for 24,895,000 tons in 1931, an increase of 5.3 per cent over the 1930 total of 23,644,000 tons. Tonnage loaded by mobile loaders dropped 3.2 per cent from 20,073,000 tons to 19,429,000 tons, while the total handled by scrapers declined from 1,637,000 tons to 1,462,000 tons, or 10.7 per cent.

Pennsylvania showed the greatest increase in production by mechanized mining, the total handled by machines rising from 7,035,000 tons in 1930 to 8,821,000 tons in 1931, or 25.4 per cent. Alabama's mechanically handled output increased 9.3 per cent from 2,056,000 tons to 2,247,000 tons. All other of the 22 states in which mechanized mining is established commercially showed declines in 1931. The drop in machine-loaded output was largest for Virginia and West Virginia, the total dropping from 3,093,000 tons in 1930 to 2,473,000 tons in 1931, or 20.0 per cent.

Mr. Clark also termed as unfair and unreasonable the provision that licensees must accept the terms of the act, and declared that individual members of the association would be liable not only for their own failure to carry out contracts but also for the failure of other members. The section of the bill providing for the making and maintenance of wage and working agreements and the settlement of disputes was attacked by Mr. Clark on the ground that it would bind operators and employees to collective bargaining, which in his experience, has proved unsatisfactory and detrimental to the industry. The Davis-Kelly bill, he concluded, carries no means of forcing the union to carry out the terms of any contract it might enter into, and provides no penalty for violations.

"I am not in disagreement with those who seek to remedy the situation, but I am firmly convinced that the Davis-Kelly bill, as prepared, places the destiny of the coal industry in the hands of a government agency which, in my judgment, is dangerous, undesirable and, we believe, unconstitutional," declared K. A. Spencer, Pittsburg & Midway Coal Mining Co., Pittsburg, Kan., on May 3. Competition from oil and gas has forced coal prices down, not competition among producers, and has resulted in the abandonment of many mines. Mr. Spencer advocated modification of the Sherman Act to give relief, as well as the removal of some of the restrictions on the railroads to enable them to assist in fighting competition from other fuels.

Further testimony in opposition to the Davis-Kelly and Lewis bills will be offered at future hearings by representatives of the following organizations and groups: Pittsburgh operators representing 31,000,000 tons annually; Association of Railway Executives; Charleston (W. Va.) Chamber of Commerce; West Kentucky Coal Bureau; Michigan Manufacturers' Association; American Gas Association; National Electric Light Association; National Retail Coal Merchants' Association; Baltimore (Md.) Association of Commerce; Alabama Mining Institute; National Lumber Manufacturers' Association; Railway Business Association; Chamber of Commerce of the United States; National Association of Manufacturers; Huntington (W. Va.) Chamber of Commerce; Big Sandy (Ky.) operators; Anthracite Institute (in case the Lewis bill, which applies to the anthracite industry, is discussed); Manufacturers' Association of Huntington, W. Va.; Appalachian Power Co.; Hazard Coal Operators' Exchange; Operators' Association of the Williamson Field; Railway Employees' and Taxpayers' Association of West Virginia; and the Southern Appalachian, Harlan County, Logan, Eastern Ohio, Fairmont, Kanawha, Virginia, Pocahontas, and New River coal operators' associations.

Gas Advertising Campaign To Start This Year

Plans for a national advertising campaign involving the expenditure of $6,000,000 in the next three years to stimulate the use of gas were announced in April by the national advertising committee of the manufacturers' section of the American Gas Association. The proposed program has been indorsed by the executive board of the association, and it is expected that it will get under way by June 15. Modernity, economy, and flexibility of gas in household cooking, heating, and cooling will be emphasized. The program is to be financed by contributions of 5 per cent of the expected sales of the manufacturer members of the association.

Reports in April indicated that the following natural gas construction is planned in the near future:

Midland, Tex., to Topolobampa, Mexico; 600-mile natural-gas line with branches to Torreon and possibly Mexico City.

Geneseo, Ill., to Milwaukee, Wis.; options on right of way for natural-gas pipe line secured, through no construction plans have been announced.

Baker-Glendive field, Montana, to Minneapolis and St. Paul; surveys for 580-mile, 24-in. natural-gas line under way; plans for bringing natural gas to Minneapolis approved by city council, March 15.

T. H. Aldrich Dies

Truman H. Aldrich, consulting mining engineer and pioneer Alabama operator, died at Birmingham, Ala., April 28, at the age of 83. Mr. Aldrich was graduated from Rensselaer Polytechnic Institute in 1869, and soon after engaged in banking in Alabama. Shortly afterward, he opened the Montevallo mine, and later engaged in the development of 30 operations in the state. With Colonel Sloss and H. F. DeBardeleben he organized the Pratt Coal & Coke Co. and produced the first furnace coke in Alabama. At one time he was president of the Sloss-Sheffield Steel & Iron Co. and later was vice-president and general manager of the Tennessee Coal, Iron & R.R. Co. From 1913 on, Mr. Aldrich devoted his time to consulting engineering.

Associations

James B. Smith, San Francisco, Calif., president of the King Coal Co., Utah, was elected president of the Utah Coal Producers' Association at the annual meeting held last month. Other officers were reelected as follows: vice-president, L. R. Weber, vice-president, Liberty Fuel Co., Salt Lake City; secretary-treasurer, John R. Doolin, also of Salt Lake City.

Lee Long, vice-president, Clinchfield Coal Corporation, was elected president of the Virginia Coal Operators' Association at the annual meeting held in April. R. S. Graham, vice-president, Wise Coal & Coke Co., Norton, Va., was chosen vice-president, and C. B. Neel, Norton, was reelected secretary.

The Late Truman H. Aldrich

A.I.M.E. Men Visit Museum Of Science and Industry

The Museum of Science and Industry at Chicago, dedicated to the display of life-size working models of machines and methods used in modern industry, was visited by the advisory committee of the American Institute of Mining and Metallurgical Engineers on April 11 and 12. Coal men on the advisory committee are: A. C. Callen, head of the mining engineering department, University of Illinois, Urbana, Ill.; John A. Garcia, consulting mining engineer, Allen & Garcia Co., Chicago; C. T. Hayden, general manager, O'Gara Coal Co., Chicago; and C. C. Whittier, consulting engineer, Robert W. Hunt Co., Chicago. The committee spent two days in inspecting the exhibits and drawing up recommendations for incorporation into the museum procedure

Exhibits at the museum are divided into ten "sequences," as follows: fundamental sciences; geology and the mineral industries; agriculture, textiles, and forestry; power generation, transmission, and distribution; highway, rail, water and air transportation; civil engineering; and the graphic arts and communication. The coal-mining exhibit includes a full-size operating coal tipple and an underground section devoted to coal cutting, drilling, shooting, and loading operations in low-vein, longwall, and room-and-pillar mines, supplemented by exhibits portraying safety and economics.

B. C. Fuel Reserves Released

Coal, oil, and natural gas reserves in British Columbia were released by the provincial government April 19 in preparation for intensive development by private parties. Included in the areas opened up to private exploration and exploitation is the Ground Hog coal reserve in the northern part of the province.

Ohio Safety Awards Made At Congress Meeting

Award of certificates to mining companies with the best records in the three months' safety campaign sponsored by the Division of Mines and Minerals and the Division of Safety and Hygiene of the Ohio Industrial Commission was a feature of the fifth All-Ohio Safety Congress, held in Columbus, April 19 and 20. Nearly 4,500,000 tons was produced in the three months by the companies participating, which represented 95 per cent of the production of the state, and, in comparison with the first quarter of 1931, the number of accidents was reduced 50 per cent. Only four fatalities occurred, against eleven in the first three months of 1931.

For mines employing up to twenty men, 146 separate operations were awarded certificates for operating without a lost-time accident. Eighteen mines employing from 20 to 100 men received certificates; the Consumers Mining Co. led the class in tonnage produced. For mines employing from 100 to 300 men, three operations reported no lost-time accidents, as follows: Carrow Mining Co., Roseville; Sunday Creek Coal Co., Mine 90, Hemlock; and Mine 5, Murray City. In the class employing more than 300 men, certificates were awarded as follows: Manhattan Coal Co., Hocking & Athens Mine, Nelsonville; Hanna Coal Co., Dillon No. 9, Fairpoint; Rail & River Coal Co., Mine 6, Bellaire.

Addresses were given by the following during the course of the meeting: "Safety in Ohio Mines as Viewed by an Engineer," H. E. Nold, head of department of mining engineering, Ohio State University; "Organization and Its Relationship to Safety," A. G. Squibb, general superintendent, Youghiogheny & Ohio Coal Co. C. W. Jeffers, general superintendent, United States Coal Co., discussed safety at the operations of his company. Mr. Jeffers was elected chairman of the congress for the coming year, and Clyde Augsburger, mining engineer, National Fireproofing Co., East Canton, was chosen vice-chairman.

The Alloy (W. Va.) mine of the Electro-Metallurgical Co., in Fayette County, has completed a year's operation without a lost-time accident. During this time, an average of 140 men were employed. Total man-hours of exposure was 343,778 in loading, transporting, and dumping 129,153 tons of coal and 92,988 tons of rock.

Alabama mines produced over 1,000,000 tons of coal in March without a single fatality, a record never before equaled in that state.

Aaron B. Davidson, mine foreman, DeBardeleben Coal Corporation, Sipsey, Ala., was awarded the President's Medal of the National Safety Council on April 22 for his work in resuscitating John E. Thomas, superintendent, who suffered an electric shock from lightning while talking over the mine telephone on July 17, 1931.

Illinois and Indiana Deadlock Continues; Strike Cuts Ohio Production

THE deadlock between Illinois and Indiana operators and the United Mine Workers in the respective states continued in April, though some strip and shaft operations started up under temporary agreements in addition to those that continued to work after the old wage agreement expired on March 31. The Illinois subcommittee of operators and miners charged with the responsibility of determining a basis for negotiations in that state resumed deliberations April 13, but failed to reach an agreement and called for a meeting of the general committee on April 15. The general committee failed to agree on instructions to the subcommittee in continuing its efforts, with the result that negotiations were adjourned *sine die*. The operators insisted that the subcommittee be instructed to work out a wage scale and agreement which would take into consideration present living costs and competitive wage scales, while the miners contended that the subcommittee should continue its deliberations without instructions.

Union representatives reported 90 shaft and strip mines working in Illinois late in the month under temporary agreements, but this total was disputed by the operators, who pointed out that many of these operations are cooperative mines that do not pay the union scale, and that others were small wagon operations.

At the instance of Governor Leslie, Indiana operators and miners resumed negotiations for a wage scale on April 13, after the operators had called for their men to return at the following scale:

	Per Day
Motormen	\$4.49
Tracklayers, cagers, trip riders, timbermen, jerrymen, pumpers	4.00
Top men	3.50
	Per Ton
Loading, machine-mined coal	\$0.439
Loading, pick-mined coal	0.600

Hopelessly deadlocked, the conferences were terminated on April 25, after the miners refused to consider the operators' proposition that wages be cut 34 per cent.

Prior to the calling of the conference by Governor Leslie, Sullivan and Vigo counties were the scene of a number of riots and attacks on working shaft operations, which were largely cooperative. Several operators requested both state and federal protection. Strip operations, which worked under the terms of a temporary agreement, proved to be a thorn in the sides of the shaft miners, with the result that there was some agitation for closing them down early in the month.

Ohio production fell to a fraction of the normal figure in April as a result of the efforts of the miners to close down all operations in the state in response to a strike call issued in March by officials of District 6, United Mine Workers. The Ohio National Guard moved into eastern Ohio on April 14 after one man was killed and a score of others were injured in an attack on the Somers mine of the Wheeling Township Coal Mining Co., which continued to work at a higher scale than other operations. A second attack on the Somers mine on April 18 was repulsed by the National Guard after three men had been wounded by rifle fire. Similar attacks occurred at other operations in the region.

Several companies operating in Belmont County abandoned plans to reopen their mines after a conference on April 27, which was participated in by eastern Ohio operators and Adjutant General Frank D. Henderson. Practically three-fifths of the guardsmen were withdrawn from the region late in April, and the month ended with comparative quiet restored. Outside of a number of mines in the Cambridge and Tuscarawas fields and several wagon operations in the Hocking Valley, almost all Ohio operations were affected by the stoppage.

Secretary of Labor Doak took a hand in the Ohio situation on April 13 with a request to Ohio operators to meet with him and representatives of the miners to evolve an agreement to end the controversy between the two interests. Ohio operators, however, refused to attend, with the result that the Secretary sent out a second call for a conference. The operators, in reply to the second call, stated that they had individually decided to run on the open-shop basis, and that any discussions must conform to this principle. This reply was construed by Secretary Doak as a refusal. The operators, in explanation of their stand, contended that they could not recognize the United Mine Workers until all fields were unionized.

Attempts to extend the Ohio stoppage to the Northern Panhandle of West Virginia met with little success, though most of the mines in the region were picketed by the strikers, and several arrests were made for intimidation. The Ben Franklin Coal Co. of West Virginia, which signed up with the union early last year, severed relations with the organization early in April when the men employed at the Panama mine were called out by union officials.

The United Mine Workers was the leader of a strike in Washington County, Pennsylvania, which affected, among other operations, those of the Duquesne Coal Co., Pittsburgh Terminal Coal Corporation (P. & W. Mine), Leech Farm Coal Co., Avella Coal Co., and the Burgettstown Coal Co. Where union agreements were in force, as at the Pittsburgh Terminal operations, union officials declared that these had been broken because the men were forced to trade at company stores and were refused checkweighmen. A further reason for the strike, according to the union, was the refusal of the operators to modify the "60-40" system of wage payments, whereby the miners received 60 per cent of the sales realization of all coal sold.

Six mines at Excelsior Springs, Mo., were closed after April 6 by miners when the operators refused demands for a wage scale of \$5 per day. The owners offered \$3.60 per day. A small group of men who attempted to operate on the cooperative basis a small mine near Excelsior Springs leased from the Clay Coal & Mining Co. were forced to abandon work on April 11 by striking miners.

The Southern Wyoming Coal Operators' Association, on April 19, transmitted to the wage scale committee, District 22, United Mine Workers, a request for a basic wage scale of \$5.42 when the present wage scale carrying a rate of \$6.72 expires on June 30. Competition of natural gas and non-union coal from other regions was given as the reason for requesting the reduction.

Twelve members of the Northern Colorado Coal Operators' Association filed notices of a wage reduction on March 31, informing the State Industrial Commission of intention to cut the present scale as follows: Underground day men, \$6.72 to \$5; loaders, 72 to 55c. per ton; top men, \$5@\$6 per day to \$4@\$4.50.

Financial Reports Issued

Island Creek Coal Co., for the year 1931, reports a net profit of \$1,520,348, after depreciation, depletion, federal taxes, and other charges, equal, after \$6 preferred dividends, to \$2.28 per share on 593,865 shares of common stock. Net profit in 1930 was \$2,402,782, or \$3.74 a share.

Consolidation Coal Co. and subsidiaries report a net loss of \$2,795,013 in 1931, after interest, depreciation, depletion, preferred dividends of the Carter Coal Co., and other charges. Net loss in 1930 was \$131,863.

Pond Creek Pocahontas Co., for the year 1931, reports a net profit of \$107,939 after interest, depreciation, depletion, and federal taxes, equal to 85c. a share on 126,404 no-par shares. Net profit in 1930 was \$340,114, or \$2.69 a share.

New River Co. reports a net profit of \$189,777 in 1931, after charges, depreciation, depletion, and federal taxes, and including a realization of \$33,019 from a suit settlement, equal to \$2.57 a share on 73,679 shares of 6 per cent preferred stock. Net profit in 1930 was \$539,392, or \$7.32 a share on the preferred stock.

Rochester & Pittsburgh Coal Co., for the year 1931, reports a net loss of \$554,508 after depreciation, depletion, interest, federal taxes, and other charges. This compares with a net profit of \$688,709 in 1930.

Clinchfield Coal Corporation reports a net loss of \$126,139 in 1931, after deduction of fixed charges, against a net loss of \$180,656 in 1930.

Boone County Coal Corporation reports a net loss of \$44,887 in 1931 after

expenses, interest, taxes, depreciation, and other charges. This compares with a net loss of $89,168 in 1930.

Pittsburgh Terminal Coal Corporation and subsidiaries, for the year 1931, report a net loss, after depreciation, depletion, and other charges, of $755,999. Net loss in 1930 was $642,945.

Consolidated Coal Co. of St. Louis reports a net profit of $19,226 in 1931 after interest, expenses, and other charges, equal to 38c. a share on 50,000 no-par shares outstanding. Net profit in 1930 was $102,642, or $2.05 a share.

Davis Coal & Coke Co., for the year 1931, reports a net profit of $128,921, after expenses, taxes, insurance, depreciation, and depletion, equal to $2.45 a share on 52,547 shares outstanding. Net profit in 1930 was $218,529, equal to $4.12 a share on 53,091 shares.

Alabama Fuel & Iron Co. reports a net profit of $187,194 in 1931, after taxes, insurance, depreciation, and other charges, equal to $5.25 a share on 35,000 shares outstanding. Net profit in 1930 was $148,362, or $4.24 a share.

American Coal Co. of Allegany County, for the year 1931, reports a net loss of $37,142, after taxes, depreciation, depletion, and other charges. Net profit in 1930 was $158,725, or $3.29 a share on 48,254 shares of stock.

Utah Fuel Co. reports a net loss of $109,119 in 1931, after expenses and other charges. This compares with a net profit of $5,889 in 1930, or 6c. a share on 100,000 shares.

Winding Gulf Collieries reports a net loss of $114,533 in 1931, after taxes, depreciation, depletion, and other charges. This compares with a net profit of $148,742 in 1930, or $7.44 a share on 20,000 shares outstanding.

West Kentucky Coal Co., for the year 1931, reports a net loss of $112,927, after expenses, maintenance, taxes, depreciation, appropriation, and other charges. Net loss in 1930 was $40,578.

Cosgrove-Meehan Coal Corporation, for the year 1931, reports a net loss of $215,737 after expenses, depreciation, depletion, and other charges, against a net profit of $8,978 in 1930.

Dominion Steel & Coal Corporation, Ltd., and subsidiaries report a net loss of $372,129 in 1931 after interest, depreciation, and depletion. Dominion Coal Co., Ltd., reports a net loss of $1,223,071 in 1931 after depreciation and other charges, against a net loss of $149,424 in 1930.

Pittston Co. and wholly or partly owned subsidiaries report for 1931 a net profit of $286,333 after interest, depreciation, depletion, amortization, federal taxes, subsidiary dividends, loss on sale and demolition of property, and other charges, but before depreciation on certain buildings, equal to 26c. per share.

Truax-Traer Moves Offices

Truax-Traer Coal Co. has removed its general offices from Chicago to the First National—Soo Line Building, Minneapolis, Minn. A Chicago office will be maintained in the Bell Building.

Promotion of Illinois and Indiana Coals Theme of Mid-West Conference

PROMOTION of the use of Illinois and Indiana coals through more efficient utilization was the theme of the Fifth Annual Midwest Bituminous Coal Conference, held at Purdue University, Lafayette, Ind., April 14-15, under the sponsorship of Purdue University and the University of Illinois, in cooperation with the Coal Trade Association of Indiana, Illinois Coal Bureau, Illinois State Geological Survey; the National Association of Power Engineers; and the Fuels Division of the American Society of Mechanical Engineers. A total of 320 retail coal dealers, operators, steam coal buyers, stoker men, and engineers were in attendance.

Natural-gas competition and the reconditioning of power plants to use Middle Western coals were the topics at the first, or industrial, session on April 14, with Jonas Waffle, managing director, Coal Trade Association of Indiana, presiding. The onset of natural-gas competition usually finds the coal men unprepared with the necessary data on the relative operating efficiencies of gas and coal, declared J. G. Bentley, fuel engineer, O'Gara Coal Co., Chicago. This conclusion was brought home to coal men in the Northwest when municipal properties were lately approached by natural gas companies. Lack of operating data on coal and gas indicated the desirability of a comparison between the two fuels in an existing plant, and this opportunity was afforded through the installation of an additional boiler at the municipal light plant at Rochester, Minn.

The Minnesota Northern Natural Gas Co. offered to supply natural gas to the municipal plant for a trial period of one year, and agreed to bear the expense of bringing the gas to the plant; making the necessary changes in boiler equipment to permit installation of gas burners; install and maintain meters; and install a fuel-oil standby.

The public utility board finally decided to try gas for a period of one year at 22c. per thousand, with an option of renewing at the end of the year for four years at the same rate, the city thereupon to reimburse the gas company for the expense of installing the equipment. The interested coal men immediately laid plans for running a comparative test in the plant, which was set for Feb. 24-26. The gas company, however, failed to go through with its part of the program, and steps are now being taken for running a 10-day test on both fuels in the future under A.S.M.E. standard test conditions.

Returns of 15 to 35 per cent on the investment in new power plant equipment to burn the cheaper sizes of Middle Western coals were cited by H. A. Eggert, combustion engineer, Old Ben Coal Corporation, in a paper on "Reconditioning of Power Plants to Use Mid-West Coals." Mr. Eggert cited more than twenty examples of savings through the installation of modern stoker or pulverized coal-firing equipment and the adoption of efficient operating methods.

Research formed the theme of the evening session on April 14, with Milton E. Robinson, Jr., president, National Retail Coal Merchants' Association, presiding. M. M. Leighton, chief, Illinois Geological Survey, described the results of coal research studies carried on in the experiment station laboratories at Urbana, and A. A. Potter, dean of engineering, Purdue University, and M. S. Ketchum, dean of engineering, University of Illinois, discussed the value of coal research and the contributions of educational institutions to industry.

Retail dealers had their innings at the first session on April 15. L. E. Shuttleworth, Indiana Coal Merchants' Association, presided. A therm contract, involving the sale and purchase of coal on the basis of definite amounts of useful heat, was suggested by C. E. Plummer and C. C. Whittier, Robert W. Hunt Co., Chicago. Purchase with the therm contract would be based on a standard system of sampling at the mines, and a therm certificate would be forwarded with each car shipped, and would serve as the basis of payment.

The majority of home owners change to oil and gas because of the character, condition, and operation of the coal-heating plant, declared C. J. Klermund, president, Klermund Heat Service, Chicago, in discussing "Trouble-Shooting in Small Heating Plants." Where the coal man renders the proper service to the heating equipment, customers usually are satisfied with coal-burning equipment.

Clarification of some points of difference between coal men and stoker manufacturers was the order of business at the stoker session which wound up the conference on April 15. B. R. Gebhart, director of public relations, Illinois Coal Bureau, presided. Prior to the meeting, questionnaires were sent to fifteen of the larger stoker manufacturers of the country, and a digest of the replies was presented by W. T. Miller, assistant professor of mechanical engineering.

Addresses and discussion at the stoker sessions laid emphasis on the desirability of certain basic changes in stoker design for the purposes of burning medium-ash coals more successfully with fusion temperature of ash less than 2,300 deg. Such changes it was brought out, would not only increase the variety of coals that could be handled successfully by the stokers but also would result in better operation with higher grade types. In addition, adoption of the changes would reduce the number of special coals that the retailer is now forced to handle.

Tank Car for Dry Materials

A new tank car for transporting dry, granular commodities, such as cement, flour, pulverized coal, and similar materials, has been developed by the General American Tank Car Corporation. The car has a capacity of 60 tons and is said to be absolutely watertight. Unloading is accomplished through an opening in the bottom, the material being pulled to the opening from the ends of the car by two continuous, motor-driven, drag-chain conveyors.

Industrial Lubricants Series

Lubrication of equipment will be the theme of a series of technical monographs which the technical division of the Standard Oil Co. (Indiana), 910 South Michigan Avenue, Chicago, will distribute each month. The company plans to cover each of the more important industrial applications, and will deal each month with some one type of equipment.

Personal Notes

J. D. A. Morrow, president, Pittsburgh Coal Co., Pittsburgh, Pa., has been elected a director-at-large of the National Coal Association.

Fred W. Braggins, president of the Lorain Coal & Dock Co. for the past seventeen years, resigned on April 11, and will look after his personal affairs until he makes another connection.

D. D. Hull, Jr., Roanoke, Va., formerly vice-president in charge of operations and sales, was elected president and general manager of the Virginia Iron, Coal & Coke Co. at the meeting of board of directors last month.

Malcolm MacFarlane, formerly chief fuel inspector, New York Central Lines, has joined the organization of the Bird Coal Co., Philadelphia, Pa.

Obituary

Major Joshua F. Bullitt, vice-president and general counsel of the Stonega Coke & Coal Co., Virginia Coal & Iron Co., and the General Coal Co., died at his home in Philadelphia, Pa., April 21, at the age of 75, following a long illness.

Robert G. Worthington, 50, president of the National Fuel Co., Denver, Colo., died April 13 of spinal meningitis. Mr. Worthington, who was born in Fort Royal, Va., was educated abroad as a mechanical engineer, and subsequently spent three years before the mast on a sailing vessel, later serving with the British army in South Africa. He later spent six years in a British dyeing and weaving plant, and then returned to the United States to take a position with the Bethlehem Steel Co. From 1917 to 1925, he was president of the Pittsburgh Oil Refining Co., and then moved to Denver, where he directed his efforts toward the development of the coal industry, becoming head of the National Fuel Co. in 1928.

Dr. George H. Sherman, president of the Sherman Coal Corporation, Pottsville, Pa., died at Melbourne, Fla., April 20, at the age of 73. Dr. Sherman was a medical graduate and founded the bacteriological institute in Detroit, Mich., which now bears his name. With his brother, he founded the Sherman Coal Corporation in 1917, later retiring from active participation to live in Florida.

R. J. Jones, 60, assistant chief engineer, Sunday Creek Coal Co., died at his home in Columbus, Ohio, April 10, after a lingering illness. Mr. Jones was connected with the Sunday Creek company for 32 years.

James Casey, 53, superintendent, Mine 81, Brewerton Coal Corporation, died at his home in Springfield, Ill., April 10, after a protracted illness.

F. E. Hess, secretary of the Premier Coal Co., died suddenly at Middlesboro, Ky., April 29, after 30 years spent in the coal industry of Bell County.

Joseph Leiter, 63, capitalist, sportsman, president of the Zeigler Coal & Coke Co., and founder of the town of Zeigler, Ill., died at his home in Chicago, April 11, of pneumonia and heart disease.

William Kerr Kavanaugh, 72, president of the Southern Coal, Coke & Mining Co., Illinois, and the Bell Coal & Navigation Co., Kentucky, died at his home in St. Louis, Mo., April 27, of pneumonia. Mr. Kavanaugh started in the coal business in St. Louis in 1905, and actively entered into projects for the development of waterways from the Great Lakes to the Gulf in 1906. He was president of the Lakes-to-the-Gulf Deep Waterways Association until it was merged with the Mississippi Valley Association, and was a member of the board of the National Rivers and Harbors Congress and Steam Navigation.

Coming Meetings

Chamber of Commerce of the United States; twentieth annual meeting at San Francisco, Calif., May 17-20.

National Association of Purchasing Agents; annual meeting, June 6-9, Book-Cadillac Hotel, Detroit, Mich.

Rocky Mountain Coal Mining Institute; annual meeting, June 8-10, at Salt Lake City, Utah.

Illinois Mining Institute; annual boat trip and summer meeting on S.S. "Cape Girardeau," leaving St. Louis June 10 and returning June 12.

Southwestern Interstate Coal Operators' Association; annual meeting at 300 Keith & Perry Bldg., Kansas City, Mo., June 14.

Colorado and New Mexico Coal Operators' Association; annual meeting, Boston Building, Denver, Colo., June 15.

American Society for Testing Materials; annual meeting, June 20-24, Atlantic City, N. J.

American Institute of Electrical Engineers; annual summer convention, Cleveland, Ohio, June 20-24.

Mining Society of Nova Scotia; annual meeting at Baddeck, N. S., June 28-9.

Industrial Notes

James S. Watson, vice-president in charge of the Dodge Works, Indianapolis, Ind., has been made vice-president and general manager of both the Dodge and Ewart chain works of the Link-Belt Co., succeeding George P. Torrence, recently elected president of the company. Frank S. O'Neil, manager of the Dodge works, has been appointed assistant general manager of both plants. C. Walter Spalding, connected with the Ewart staff for a number of years, has been appointed sales manager in charge of the Ewart plant products.

Norma-Hoffmann Bearings Corporation, Stamford, Conn., has removed it New York office to 155 East 44th Street.

Reliance Electric & Mfg. Co., Cleveland, Ohio, has established a sales branch at 208 Fuller Ave., Grand Rapids, Mich., in charge of Marshall T. Ball.

Dust Recovering & Conveying Co., Cleveland, Ohio, has established a foreign business office to license manufacturers to build and sell in their individual territories dust-collecting and pneumatic conveying equipment based on the Dracco designs.

Sullivan Machinery Co. has removed its Knoxville (Tenn.) branch office to 803 Medical Arts Building.

Peerless-Union Explosives Corporation was merged with the Atlas Powder Co., Wilmington, Del., March 1, and all plants and business are now handled by the Atlas company. New Atlas sales offices, as a result of the merger, are located at Tamaqua, Pa., and Charleston, W. Va. Other Peerless-Union offices will be merged with existing Atlas offices.

Frank Kalas, formerly district manager, has been appointed assistant general sales manager of the Electric Storage Battery Co., Philadelphia, Pa.

North C. Shaver, sales manager of the Penn Machine Co., Johnstown, Pa., for the past ten years, has been appointed vice-president and general manager of the company.

Col. J. S. Ervin was elected president of the Mackintosh-Hemphill Co., Pittsburgh, Pa., manufacturer of castings and other machinery for coal mining, April 6. F. Hughes Moyer was elected vice-president and senior engineering officer; and H. E. Field, formerly president of the Wheeling Mold & Foundry Co., was elected vice-president.

Coal Mine Fatalities and Death Rates Decline in March

UNITED STATES coal mine accidents in March, 1932, caused the death of 98 men, according to information furnished the U. S. Bureau of Mines by state mine inspectors. Production in March was 37,039,000 net tons, giving a death rate of 2.65 per million tons. In February, 1931, the death rate was 4.15, based on 133 fatalities in mining 32,032,000 tons, including one explosion which caused 38 deaths. In March, 1931, the death rate was 3.06, based on 118 deaths in producing 38,615,000 tons.

For bituminous mines alone, the March, 1932, death rate was 2.29. Output in March was 32,250,000 tons, and 74 men were killed. February, 1932, death rate was 4.00, based on 112 deaths in mining 28,013,000 tons, while the rate in March, 1931, was 2.75, based on 93 deaths in producing 33,870,000 tons.

Twenty-four men lost their lives in the anthracite mines of Pennsylvania in March, 1932. Production was 4,789,000 tons, giving a fatality rate of 5.01 per million tons. This compares with 5.23 in February, when 4,019,000 tons was mined, and 21 men were killed, and 5.27 in March, 1931, based on 25 deaths in mining 4,745,000 tons.

During the first three months of 1932, United States coal mine accidents resulted in a total loss of 326 lives. Production in this period was 100,860,000 tons, giving a death rate of 3.23, as compared with 3.42 in the same period in 1931, when 411 lives were lost in producing 120,113,000 tons. Bituminous mines produced 88,155,000 tons in the first quarter of 1932, and 266 men were killed, resulting in a fatality rate of 3.02. In the first quarter of 1931, 303 fatalities occurred in producing 103,820,000 tons, resulting in a rate of 2.92. Anthracite mines produced 12,705,000 tons of coal in the first three months of 1932; 60 men were killed, making the rate 4.72. In the first quarter of 1931, 108 anthracite miners were killed in mining 16,293,000 tons, giving a fatality rate of 6.63 per million tons.

No major disasters—that is, disasters causing the death of five or more men—occurred in March. One disaster in January caused six deaths, and a second in February resulted in 38 fatalities, making the combined disaster fatality rate 0.436 in the first quarter of 1932. This compares with 0.341 in the same period in 1931, when 41 deaths were caused by three major disasters. Major disasters in 1932 have thus far occurred at the rate of 1.98 separate disasters (as distinguished from the number of deaths resulting from such disasters) per 100,000,000 tons of coal produced, as compared with a rate of 2.50 in the first quarter of 1931.

A comparison of the accident rates of all classes during the 3-month period of 1932 with those for the same period in 1931 shows a reduction in falls of roof and coal, haulage, and explosives, but higher rates for gas or dust explosions and for electricity.

Fatalities and Death Rates at United States Coal Mines, by Causes*

Cause	Bituminous Number Killed	Bituminous Killed per 1,000,000 Tons	Anthracite Number Killed	Anthracite Killed per 1,000,000 Tons	Total Number Killed	Total Killed per 1,000,000 Tons
January - March, 1931						
All causes	303	2.919	108	6.629	411	3.422
Falls of roof and coal	159	1.532	61	3.744	220	1.832
Haulage	59	.568	11	.675	70	.583
Gas or dust explosions:						
Local explosions	...	.....	5	.307	5	.042
Major explosions	41	.395	...	.....	41	.341
Explosives	3	.029	7	.430	10	.083
Electricity	9	.087	1	.061	10	.083
Surface and miscellaneous	32	.308	23	1.412	55	.458
January - March, 1932						
All causes	266	3.017	60	4.723	326	3.232
Falls of roof and coal	139	1.577	35	2.755	174	1.725
Haulage	40	.454	8	.630	48	.476
Gas or dust explosions:						
Local explosions	1	.011	...	.....	1	.010
Major explosions	44	.499	...	.....	44	.436
Explosives	3	.034	4	.315	7	.070
Electricity	10	.113	3	.236	13	.129
Surface and miscellaneous	29	.329	10	.787	39	.386

* All figures are preliminary and subject to revision.

Coal-Mine Fatalities During March, 1932, by Causes and States

(Compiled by Bureau of Mines and published by *Coal Age*)

State	Underground												Shaft					Surface							Total by States	
	Falls of roof (coal, rock, etc.)	Falls of face or pillar coal	Mine cars and locomotives	Explosions of gas or coal dust	Explosives	Suffocation from mine gases	Electricity	Animals	Mining machines	Mine fires (burned, suffocated, etc.)	Other causes	Total	Falling down shafts or slopes	Objects falling down shafts or slopes	Cage, skip, or bucket	Other causes	Total	Mine cars and mine locomotives	Electricity	Machinery	Boiler explosions or bursting steam pipes	Railway cars and locomotives	Other causes	Total	1932	1931
Alabama																									0	2
Alaska																									0	0
Arkansas																									0	0
Colorado	1	2										3													3	3
Illinois	5		1			1			1			8													8	5
Indiana	2		1				1					4													4	2
Iowa	1											1													1	0
Kansas	1				1							2								1			1	2	4	1
Kentucky	7						2					9													9	11
Maryland																									0	0
Michigan			1									1													1	0
Missouri	1											1													1	0
Montana																									0	1
New Mexico																									0	0
North Dakota																									0	0
Ohio	3											3													3	10
Oklahoma															1		1								1	0
Pennsylvania (bituminous)	6	1	2						2			11						1		1				2	13	14
Tennessee	1		1									2													2	0
Texas																									0	0
Utah																									0	2
Virginia	2											2										1		1	3	2
Washington																									0	1
West Virginia	10	3	5		1							19											1	1	20	34
Wyoming			1									1													1	3
Total (bituminous)	40	6	12		2	1	3		3			67			1		1	1		2		1	2	6	74	93
Pennsylvania (anthracite)	7	5	2		1	1	2				4	22						1					1	2	24	25
Total, March, 1932	47	11	14		3	2	5		3		4	89			1		1	2		2		1	3	8	98	....
Total, March, 1931	57	11	25	1	4	2	3		1		4	108	1	2			3	2	1	1	1	2		7	......	118

WHAT'S NEW

IN COAL-MINING EQUIPMENT

New Brush Material

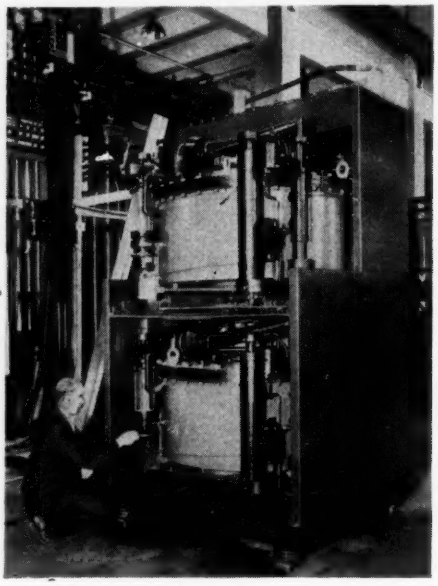
National Carbon Co., Inc., Carbon Sales Division, Cleveland, Ohio, announces a new electrographitic brush, known as National Pyramid Grade No. 234. The company stresses the non-resilient structure, a property which enables the brush to maintain exceptionally firm contact on commutators of high peripheral speed. It is announced that excellent commutation, low friction, and high carrying capacity combine with the smooth riding properties of this new material to minimize brush wear and commutator maintenance. The field of application of this new grade, according to the company is in heavy-duty direct-current generating and substation equipment.

Flashless Circuit Breaker

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., offers the AB "De-ion" circuit breaker for circuit protection in buildings, homes, industrial plants, mines, and other places where electricity is used. The "De-ion" breaker, according to the company, is a safe, flashless device which performs the function hitherto left to carbon circuit breakers and fuses. Advantages stressed by the company are: No parts to be replaced or renewed; can be reclosed as quickly and easily as a switch; cannot be held closed against an abnormal overload or short-circuit, or blocked to prevent opening the circuit; rating cannot be changed by unauthorized persons; a time lag is provided to prevent tripping on light momentary loads; space requirements are only 70 per cent of those of a carbon breaker; and the breaker opens without noise or flash. Fifteen- to 50-amp. breakers are available in 1-, 2-, and 3-pole combinations for 125 and 250 volts; 55- to 600-amp. breakers are available in 2- and 3-pole combinations up to 575 volts.

Three-Pole, 225-Amp. "De-ion" Breaker

Westinghouse also has developed a new mercury-arc rectifier consisting of two interchangeable units mounted on rollers one above the other. The rectifiers are said to be more efficient and smaller than previous units. A 1,500-kw. unit is illustrated, being made up of two 750-kw. units. Turning a hand crank rolls either of the 750-kw. units free of its connections.

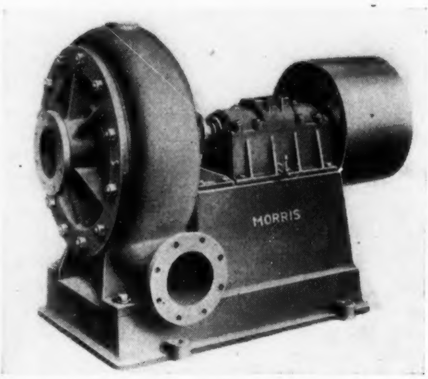


1,500-Kw. Sectional Mercury-Arc Rectifier

Sand Pump

Morris Machine Works, Baldwinsville, N. Y., has supplemented its line of standard, medium- and heavy-duty centrifugal dredging pumps with a new pump of simpler construction, known as the Type L sand pump. This unit has been developed for handling sand, silt, and other abrasive materials.

Centrifugal pumps for these severe services, according to the company, should be designed to provide operation for long periods before requiring renewals, maintenance of initial efficiency in spite of wear, and renewals at small cost and with minimum interruption to service. To meet the first standard, the parts of the new sand pump which are subject to wear (shell, impeller and suction disk) are declared to be heavily proportioned and made of hard semi-steel containing admixtures of nickel for resistance to abrasion and wear. To meet the second standard, the impeller assembly is designed for adjustments to take up wear. To meet the third standard, the pump parts which may require renewal after long service are designed to be inexpensive and quickly replaced.



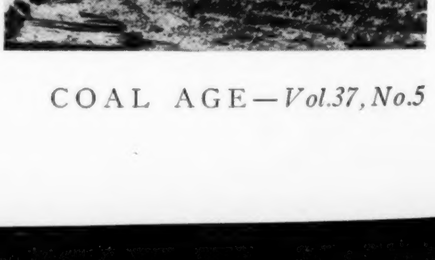
Type L Sand Pump

In addition, all vibration is said to be eliminated by a rigid connection between the casing and the frame, and also by an extra large forged steel shaft supported in a double inclosed bearing. These pumps are built in sizes from 4 to 12 in. and for either belt drive or direct connection to driver.

Dragline Excavator

Bucyrus-Erie Co., Milwaukee, Wis., offers the 45-B dragline. An outstanding feature of this machine, according to the company, is the long, tapered, caterpillar-type mounting, which is said to give lowest ground pressure, greater clearance under the frame, and easy propelling, even in heavy, sticky mud. The 45-B machine may be equipped with a 2- to $2\frac{1}{4}$-yd. bucket on a 50-ft. boom,

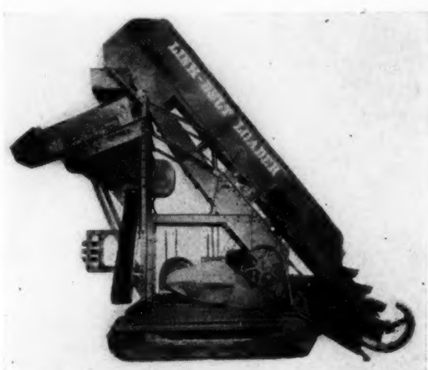
45-B Dragline



or a $1\frac{1}{4}$- to $1\frac{1}{2}$-yd. bucket on a 65-ft. boom. Other boom lengths up to 80 ft. are available. Booms are built of alloy steel, and the machine is steered like a tractor through clutches controlled by a lever at the operator's side. Sharp or gradual turns can be made with the cab in any position, the company declares. The machine is not convertible to a shovel, though it is readily adaptable to clamshell or crane service.

Portable Loader

Link-Belt Co., Philadelphia, Pa., announces the 1932 model vibrating screen loader for loading coke, coal, sand, and gravel, and similar materials. Improvements include the addition of a Link-Belt positive-drive vibrating screen. With this screen, the amplitude of vibration is fixed at the factory, though inclination can be adjusted between 18 and 25 deg. to suit the material handled. The new screening arrangement, the company says, provides greater clearance (10 ft.) under the chute. The entire loader, it is said, is under the control of the operator, who stands on a large and roomy platform with all operating levers in easy reach. Elevator



Link-Belt, 1932 Model, Vibrating Screen Loader

bucket capacity is $1\frac{3}{4}$ cu.yd. per minute, and the foot of the loader is equipped with a helical feeder which clears a uniform path 7 ft. 7 in. wide. A three-speed transmission gives speeds of 30 or 66 ft. per minute forward and 27 ft. per minute in reverse.

Welding Equipment

Improvement in the Knowles electrolytic hydrogen generators has been announced by the Linde Air Products Co., New York City, in the development of a new "double-depth" generator. A number of advantages are claimed for this equipment. Capacity is 50 per cent greater than the standard generator while the space required to house a producing plant has been decreased one-third. Electrode area has been doubled, while the electrode ampere density has been decreased $33\frac{1}{3}$ per cent, resulting in a decrease of 5 per cent in power consumption, or, in terms of total plant investment, a reduction of approximately 15 per cent. Each row of generators is equipped with a set of gaswashing tanks which wash out any caustic soda vapor which might be entrained in the gases and in conjunction with the automatic water feed equipment. Both the Knowles double-depth and the Knowles standard electrolytic hydrogen generators are now being made in 36 different sizes and in capacities ranging from 166 to 15,000 amp., with productions of 2.6 to 243 cu.ft. per hour for each generator.

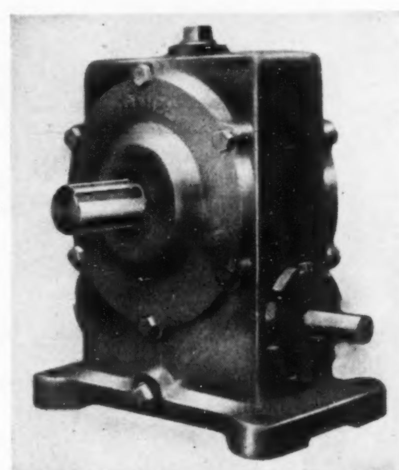
Linde Air Products Co., has added to its line of Purox welding apparatus the Purox 11-to-00 tip adaptor, which, according to the company, can be used to increase the range of usefulness of the Purox No. 11 welding torch. By means of the new tip adaptor it is now possible to use the stems and tips of the Purox No. 00-D aircraft welding torch and the stems and tips of the Purox No. 00 welding and lead-burning torch on the Purox No. 11 welding torch, thus enabling a welder who has only an occasional light welding job to use the correct welding tips for this small work. This, it is declared, eliminates the expense of investing in a complete lighting welding outfit merely for the sake of a few such jobs.

Cromaloy Flux, has been developed by the Linde Air Products Co. for use in welding the chromium-containing alloys more generally known commercially as stainless steels or rustless irons. According to the company, the ordinary fluxes used for welding or brazing are not satisfactory in welding stainless steel or rustless iron because they will not dissolve the infusible oxides, consisting chiefly of chromium oxide, which tend to form on the molten surface of these alloys. A satisfactory flux for use in welding these alloys must be sufficiently fireproof to protect the molten metal and hot metal adjacent to the weld from oxidation, and at the same time correctly compounded to dissolve the refractory chromium oxide with ease. Because of its high solvent power for chromium oxide, and its high resistance to heat, Cromaloy Flux is said to be especially prepared for this type of work, and its use, the company declares, will insure best results in welding these special chromium-iron alloys.

A new bronze welding rod, known as "Oxweld No. 25M. bronze patented welding rod," has been introduced by the Linde Air Products Co. Because of its special characteristics the company declares that this improved manganese bronze rod is unexcelled for use in the rebuilding of wear-resisting surfaces, such as piston rings or cylinder walls. Besides producing weld metal with superior wear-resisting qualities, this rod, it is said has the added advantage of begin non-fuming and exceptionally free-flowing. The rod, according to the company, is particularly effective for use in the sectional building-up of large pieces, where the weld must be made in successive layers, because there is no heavy slag formed over the weld after it has cooled. It is supplied in three sizes: $\frac{1}{8}$, $\frac{3}{16}$, and $\frac{1}{4}$ in.

Worm Gear Speed Reducers

W. A. Jones Foundry & Machine Co., Chicago, has developed a new line of worm gear speed reducers, known as Series OH. According to the company, these reducers are for small electric motor drives with capacities up to 7 hp. Ratios vary from 5 to 1 to 50 to 1.



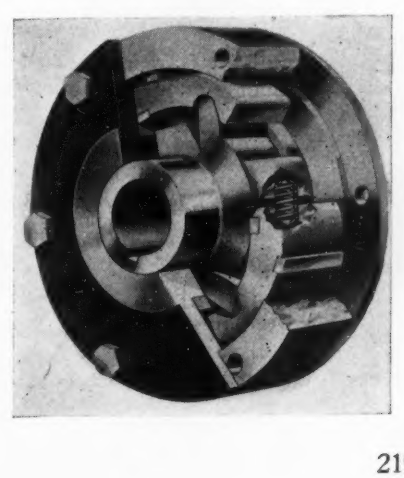
Jones Series OH Speed Reducer

They are recommended by the company for applications where light weight, space-saving dimensions, and minimum cost per unit of power transmitted are necessary. They also are adaptable to service where a right-angle drive or smooth and uniform power flow is required, the maker states.

One-Way Clutch Developed

Positive unidirectional drive is furnished by the "Pitter" one-way clutch, says the Universal Gear Corporation, Chicago, which further states that the

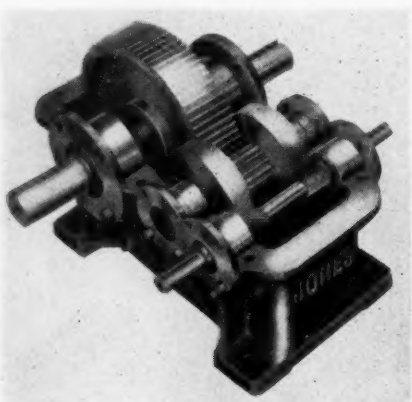
"Pitter" One-Way Clutch



clutch is instantaneous in locking and releasing, and will not slip. The equipment, it is stated, is designed to replace ratchets, "no-backs," and overrunning couplings, and for converting alternating motion, either reciprocating or rotary, into one-way movement. Driving may be done either through the outer ring or the hub in the center. The clutches range in size from $\frac{1}{2}$ to 4 in. at the shaft. Torque varies from 204 to 124,800 in.-lb.

Speed Reducers Developed

A new series of small Herringbone-Maag speed reducers also has been developed by the W. A. Jones Co., with capacities ranging up to 18 hp. Reduction ratios are from 12 to 1 up to 48 to 1. The smallest reducer in this series is $20\frac{5}{16}$ in. high, $14\frac{1}{4}$ in. long, and $10\frac{1}{4}$ in. wide at the base. For universal application, all the reducers in the series have



Herringbone-Maag Speed Reducer

high- and low-speed shaft extensions on both sides. This construction, according to the company, eliminates the need of a right- or left-hand assembly. Two shaft guards are provided. On the high-speed side, the herringbone gears and the high-speed pinion tooth are generated by rack-shaped cutters with straight sides used in a precision planer, said by the company to be the simplest and most accurate method of forming herringbone gears. On the low-speed side, the Maag tooth form is used because of the greater strength required. The combination, it is claimed, makes an exceptionally efficient, quiet, and economical speed reducer.

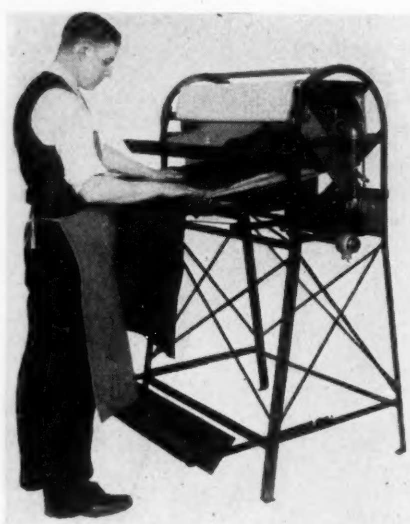
Time Switch Offered

Paragon Electric Co., Chicago, now offers the "Paragon" time switch in either key or electrically wound types. One of the features of the key-wound switch emphasized by the company is its low cost. Clocks have special steel pivots, special main springs, cushioned spring power control. In addition, it is asserted, "drag" between the clock and the tripping mechanism has been eliminated. Also, it is said, the setting mechanism is designed to be foolproof, with the result that nothing need be taken apart in winding or setting. The following models in the ten-day, key-wound group are available: Type A—single-pole, 15 amp., 110 volts; Type B—double-pole, 10, 20, 30, or 50 amp., 110 or 220 volts.

In the electrically wound switches, the Paragon company claims to have installed the only closed-circuit, switch-operating motor that operates without switches or contacts of any kind. Other features pointed out by the maker are: twelve-hour spring-power reserve; no high-speed gear reductions or delicate parts; overwind safety device. Two groups, indoor and outdoor types, of electrically wound switches are available. Models in the indoor group are: Type C—single-pole, 15 amp., 110 volts, a.c.; Type D—double-pole, 10, 20, 30, or 50 amp., 110 or 220 volts, a.c. In the outdoor group, Type E corresponds to Type C of the indoor group, and Type F is equivalent to Type D.

Sheet Dryer Introduced For Blueprint Work

The C. F. Pease Co., Chicago, has developed the Pease "Junior" sheet dryer, which it declares is an inexpensive dryer for medium-sized blueprints, negatives, and blue-line and brown-line prints. Also, with a chromium-plated cylinder added, the company says the machine is particularly adapted to drying photographic prints. Simplicity in

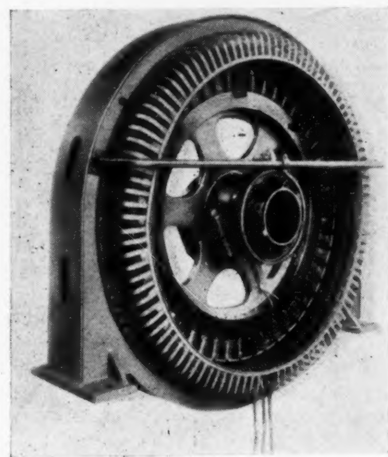


Pease "Junior" Sheet Dryer

operation, economy in maintenance, and thorough drying without wrinkles in a few minutes after printing are advantages pointed out by the makers. The revolving drying drum can be furnished with either gas or electric heating elements, and can be plated with chromium if desired.

Stator Frames Are Arc-Welded

Electric Machinery Mfg. Co., Minneapolis, Minn., announces that all its new medium- and slow-speed synchronous motors, of both the engine and coupled pedestal types, will be equipped with an arc-welded, fabricated steel stator frame.



Arc-Welded Stator Frame in 125-Hp. Synchronous Motor

This construction, according to the company, gives the following advantages: increased strength and rigidity, decreased weight, increased ventilation, and uniformity in materials and manufacturing.

Direct-Current Volt-Ohmmeter

Roller-Smith Co., New York City, has developed the new Type PD volt-ohmmeter for continuity testing, either as a direct-reading ohmmeter or a d.c. voltmeter up to 600 volts. Voltage ranges have a resistance of 1,000 ohms per volt. The voltmeter part of the instrument gives four ranges or readings, as follows: 0-3, 0-30, 0-300, or 0-600 volts; as a direct-reading ohmmeter, the instrument has two ranges: 0-10,000 and 0-100,000 ohms.

Roller-Smith Type PD Volt-Ohmmeter